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The Butte Combination

There are good combinations and bad ones. Those that promote efficiency are good. Those that are to restrain trade are bad and unlawful.

The general copper consolidation, so much talked about last fall, whereof the purpose was to elevate the price of copper, as its promoters themselves unwisely declared, promised to be of the nature of a restrainer of trade and consequently actionable.

Besides this, there was too much difficulty in bringing together a large number of interests, each claiming the lion's share of the swag. Hence the idea of two or three separate combinations. We have previously expressed the opinion that the giant combination would not be effected. It seems to be as far away as ever.

The objections that were weighty against this do not exist against combinations that simply increase efficiency. The Utah and Boston amalgamation was quite proper. So is the combination of the Butte mines, announced this week.

The Anaconda, true to its name, is to swallow the others, strange as it may appear for Amalgamated to be absorbed by one of its constituents. In its mining and smelting operations Amalgamated has always been characterized by the best possible management. The new arrangement will eliminate certain difficulties and increase efficiency. The disappearance of Amalgamated—a corporation that has never made a decent report to its stockholders—will not be regretted. We venture to say that the enlarged Anaconda will introduce a different policy and will take pride in being a great industrial enterprise rather than a stock-jobbing operation.

The Green Gold Myth

Our Toronto correspondent reports that at a meeting of the Kenora Miners and Prospectors' Association on Dec. 7, the president, Major Vereker, gave an address on the Thurber process of gold extraction. He said that he and Captain Machin, having decided to back the inventor, had set up an experimental plant where several tests had been made, giving satisfactory results. They had obtained irrefutable proof that gold had been extracted in paying quantities from comparatively worthless ore pulp. The plant was inexpensive and not complicated. Some of the results of the tests were as follows: Ore which assayed by fire 70c. to the ton before it was submitted to the process gave a return of $15.70 afterward. Ore that had assayed 70c. in a 20-lb. lot was put through the process and gave $25.65 to the ton. A 330-lb. lot, which assayed 80c. to the ton, after being treated by the process yielded $13.60. Major Vereker and Capt. Machin announced their intention of forming a company to operate the process.

The idea that there is gold hidden to the fire-assay test that will yield to a "process" is a myth that will not down. Perennially does it bob up serenely. We call it the "Green Gold Myth" because long ago, in the early days of California mining, if our recollection be correct, a faker introduced it with an ingenious explanation, to wit: The only gold that the fire-assay determines is the perfect metal such as we know in our watch-chains, coins, etc., if we are lucky enough to have them. Now there is also in some ores an imperfect, immature gold—a young gold that has not existed through sufficient geological eons to ripen, in other words "green gold"—which in its tender-

ness escapes collection by the assayer's rude methods. But by treatment with the right kind of chemicals from the nurturing hands of the "professor" this delicate gold could be ripened as quickly as Presto, change! and be put upon the same footing as its Silurian or Archean congener.

The myth undoubtedly goes further back. Perhaps an examination of the pages of Agricola would disclose that he knew of it. The alchemists in a way were believers in it. Possibly it existed even in the time of the Argonauts.

We congratulate the gentlemen who are mentioned by our Toronto correspondent upon their success in obtaining irrefutable proof that gold has been extracted in paying quantity from comparatively worthless ore, which is undoubtedly important if true. We beg them, however, to reflect upon what disastrous effect this may have upon the cost of living in the world and in the interest of humanity we hope that they will bury the secret beyond all chance of recovery.

Sound Sense

James J. Hill has long been a prophet, who unlike many has enjoyed honor in his own country. He is preëminent as a speaker of sound sense. It was he who a few years ago turned the phrase "undigested securities" into "indigestible securities" as the cause of our financial troubles of that time, later prescribed the "rest cure," and within a few days has said that our present trouble is not so much the "high cost of living" as the "cost of high living."

Now he throws light upon the attitude of Washington toward the trusts, what may happen if the Supreme Court decides adversely to the Tobacco company, and the other things that have been worrying us.

"Washington's attitude is not a menace," says Mr. Hill. "The President has to do something along this line. All over the country there is a clamor against high prices, and people look to the Government for relief. So Mr. Taft announces investigations of corporations and combinations which have been evading the laws. He couldn't do anything else.

"I don't believe that many of our companies have knowingly violated the laws governing them. If a combination has been effected in opposition to law, it will have to dissolve.

"What then? The property is all there just the same. What is the difference whether the owners have one green certificate to represent their interest, or two red ones? We have been through the same thing with the Northern Securities Company."

Mr. Hill was asked what was responsible for the depressed stock market.

"Hysteria," he replied.

Corporate Conferences

The custom is growing among large industrial companies of bringing together the heads of departments in an annual convention, at which matters affecting the interests of the company are discussed. The exchange of notes, coördination of practice, etc., that result from these meettings are advantageous.

It is interesting to note the adoption of this scheme by the mining department in Mexico of the American Smelting and Refining Company, and affiliated concerns, which held its first annual convention at Velardeña, Durango, Dec. 30 to Jan. 1. The mining department of these companies comprises the general manager and assistants of divisions, an exploration division, a general organization, a medical department, and the superintendents of mine units, of whom there are eighteen.

The schedule for the convention included discussion of the following subjects: Organization, labor and contracts, development, breaking and stoping, cost sheets, hand and machine drilling, power, hoisting, pumping, laboratory work, marketing, transportation, tramming, sorting, weighing, loading, mine sampling, taxes, state and federal laws, and others of similar character.

The discussion of such subjects is surely to the advantage of the men concerned and to the companies employing them. We hope, also, that the public may be allowed to share in the purely technical information, which may be divulged without injury to the companies especially concerned. As to this, George C. Kaufman, the general manager, stated at the convention that it is the policy of the Smelting and Securities companies to give out no information respecting the condition of their mines, operating expenses, profits, etc. However, there is no objection to superintendents contributing, under their own names, to the technical periodicals articles about the treatment of ores, new processes, or notes on practical details that will be of benefit to the profession. In this connection it is interesting to note that the new department of "Details of Practical Mining" in the JOURNAL received formal approval at this convention.

It is chiefly by the exchange of such information through the columns of the technical periodicals that progress in the art of mining is made.

The American Smelting and Refining Company, and its affiliated concerns, have heretofore been criticized for the ban of silence that they have imposed upon their technical men. It is gratifying to learn of the introduction of a broader policy in Mexico, and Mr. Kaufman is to be congratulated for his part in this. We hope that the same policy will soon be extended to the other interests of this important mining and smelting concern.

Transvaal Gold

The December returns of gold production in the Transvaal, as cabled from Johannesburg, make the total output for the year $150,488,000, an increase over 1908 of $4,711,100, or a little over 3 per cent. These figures do not differ greatly from the estimate of production made a few weeks ago. Some superficial comment has been caused by the fact that the returns for the month of December gave a total of 604,987 oz. of fine gold, whereas in December, 1908, the reported yield was 660,600 oz. It has been said that this apparent decrease represented a serious falling off in the output of the Transvaal mines. It does not appear, however, that this is at all the case. The return for December, 1909, is a practical working return, giving the actual output of the mines for the month; whereas it is well known that the figures for December, 1908, were unduly swelled by the inclusion of a quantity of miscellaneous returns and also of so-called "reserve" gold which had been held back from month to month by some of the operating companies in order to "equalize the returns" as their managers claimed. This holding back caused a great deal of comment at the time. Though the practice of reserving gold was rather lamely de-

fended by some managers, it is noticeable that this year it has been abandoned by all the prominent companies.

Some of the Transvaal managing firms have suggested that the practice of making monthly returns be hereafter abandoned; but this has met with general disfavor. It is urged that the present practice is very much fairer to stockholders generally, and that the withholding of returns would give a great advantage in speculation to directors and insiders in a position to obtain the figures. It does not appear probable that any change will be made in the present custom.

Pig Iron Production in 1909

In the review of the iron trade in 1909, published in the JOURNAL for Jan. 8, we estimated the pig-iron production of the United States for the year at 25,711,846 tons, and added: "The production of 1909 was close to that of 1907 by the estimate; so close that it is altogether possible that the final official figures may make it quite equal, if not a little greater. The difference, however, cannot be more than a few thousand tons."

This anticipation has proved correct. For the second half of 1909 the complete figures collected by the American Iron and Steel Association put the make of pig iron at 14,773,125 long tons, the excess over our estimate being due to the pushing of work in December, and to an unexpectedly large contribution from the charcoal furnaces. The figures by half-years for three years past are as follows:

	1907.	1908.	1909.
First half.	13,478,044	6,918,004	11,022,346
Second half.....	12,303,317	9,018,014	14,773,125
Year.....	25,781,361	15,936,018	25,795,471

The great production of the second half of 1909 brought the total for the year up to 14,110 tons above that of 1907, making it the greatest of any year in our history. The second-half make was not only 3,750,779 tons greater than that of the first half; it was 1,295,081 tons larger than that of the first half of 1907, the greatest previously reported.

The drop of 9,860,000 tons in production in one year was an extraordinary fluctuation, far greater than had ever before occurred. The loss was greater than the entire output of Great Britain, and greater than our own entire yearly production only a few years ago. Usually in the past when a crisis in the trade has brought about a large decrease, it has taken two or three years to return to the high point. This time the recovery was made in a single year, showing an equally extraordinary change. It is possible that the gain has been a little too fast; and we do not expect to see any increase in the first half of the current year.

A gain can be made if the demand warrants it, however. The production of the second half of 1909 was at the rate of 29,500,000 tons a year; and with the present blast-furnace capacity this can be increased to 32,000,000 tons, if the iron is needed.

The State of Trade

The depression in the stock market in January evoked the inquiry whether it did not reflect a recession in business. So far as we have been able to determine, it did not, but we think that the revival in business in the last quarter of 1909 was greatly overestimated, leading to overspeculation in the stock market and a collapse upon recognition of the actual condition.

There was no general buoyancy in business until the middle of 1909, although some branches had become active in the spring, but even up to the end of the year some branches had experienced only a slight improvement.

The dullness and weakness in the metal markets during the last six weeks indicate that the enormous deliveries for consumption in 1909 were misleading and that the supplies were not fully consumed, it being rather a case of transferal of stocks. However, the development in trade seems to be holding its own, with prospects regarded favorably and the probability of a resumption of progress before long.

The collapse of the speculative bubble that was blown in the second half of 1909 has naturally had an effect upon trade. The uncertainty over the policy of the administration as to the corporations, and the legal status of the latter under the Sherman Act, is also a demoralizing factor.

The Pape Process

One of the earliest occurrences of mixed sulphide ores, presenting a hard metallurgical nut to crack, was the deposit of the Rammelsberg in the lower Harz, Germany. Around this famous ore deposit has centered some of the most interesting metallurgical experimentation during the last 50 years and the development of the unique and classic methods that are practised at Oker and Lautenthal. Yet there has remained a large part of the low-grade, mixed and rebellious ore that has heretofore defied successful beneficiation.

It is interesting to report that this ore has lately been treated successfully by the Pape process which is based to a large extent upon American ideas as developed at Cañon City, Mineral Point, Coffeyville and elsewhere. The zinc is recovered as oxide, part of which is sold for use as a pigment and part of which is passed on to the smelters for reduction to spelter. At the Billwärder Zinkhütte, of the International Metal Company, near Hamburg, 8000 tons of spelter have already been produced from oxide obtained by the Pape process.

Enforced Reports

A new Nevada law requires all corporations, local and foreign, doing business in that State to file an annual statement and to publish it in a local paper, subject to a fine for failure so to do, which must cover the financial transactions of the corporation during the year and indicate specifically the present financial condition of the company. The authorities are planning to undertake a campaign to require the observance of the law. The requirement of such an annual statement is to be commended and will undoubtedly be of benefit, particularly to the investors who are so widely interested in the numerous Nevada corporations and who will in this way be able to obtain an official sworn statement of the financial affairs of the companies in which they have invested. The Nevada step is in the right direction and could well be followed by the other States, but what a disgrace it is that corporations should have to be compelled by law to state what they ought voluntarily to give to their stockholders.

CORRESPONDENCE and DISCUSSION

Views, Suggestions and Experiences of Readers

Accidents with Gelignite at Cobalt

The large number of powder accidents that are occurring in the mines of the Cobalt district calls for some concerted action on the part of the mine managers as to the class of explosives to be used. On looking over the causes of these accidents, a large proportion of them can be traced to the use of gelignite. This blasting compound has several advantages over common dynamite, chief of which are its greater breaking power and comparative freedom from noxious gases when exploded. It is, however, much more sensitive when it is frozen than under normal conditions, and when in the former state can usually be exploded by a blow from a pick.

The manual of explosives of the Ontario Bureau of Mines says: "Gelignite possesses many advantages over common dynamites and is rapidly supplanting them in most European countries. It is not, however, as safe a material, being entirely untrustworthy in cold weather."

The accidents from blasting compounds in Cobalt mines occur with much greater frequency in winter than in summer, thus showing the effect of the cold weather on the powder. Many of the mines use only the straight dynamite, while some have made a practice of using dynamite in the winter and gelignite in the summer. Others still continue to use gelignite all the year round.

Some time ago the Ontario Bureau of Mines considered having an act passed to prohibit, during the winter months, the use of those powders that are particularly unsafe in cold weather, but decided that it would be too much like interference with personal rights, and so the matter was dropped.

OBSERVER.

Cobalt, Ont., Jan. 29, 1910.

A Bureau of Mines?

The communication by Royal P. Jarvis in the JOURNAL of Jan. 22, is in keeping with most of the arguments advanced in opposition to the establishment of a Federal bureau of mines.

The essence of the whole article is that, should the Federal authorities create a bureau of mines, the men engaged in the research work provided by said bureau would trespass upon what its critics consider the legitimate field of activity of the mining engineer. In other words, they are opposed to any line of Federal activity which may possibly lessen the field of employment open to the professions.

If this argument were carried to its logical conclusion we would do away with the Geological Survey, because most of the work now carried on by the Survey, outside of the statistical branch, might be accomplished by the mining geologist. I can see how the field for the mining geologist might be greatly enlarged if the Geological Survey were abolished, but would the JOURNAL join in a movement to have the Geological Survey abolished? It is not easy to conceive of an engineer or a scientific man who is so narrow as to oppose any proposed Federal bureau which has for its purpose investigations looking to the betterment of our industrial life.

It may be of interest to the readers of the JOURNAL to know that the bureau does not contemplate any work which will encroach upon the field of the mining engineer, the investigations being of such a character as to apply to the broad, fundamental problems in which the mining engineer has little or no time to engage. Since some of the foremost mining engineers of the country are ardent advocates of the bureau of mines, I think it would be difficult to find an organization of mining men in the country that would not support it were the facts fairly presented to them. Kindly refer to the action taken by the American Association for the Advancement of Science, the Association of State Geologists, the Association of Mining Inspectors, the American Mining Congress, etc.

I am aware of the position taken by the JOURNAL in this matter, but would like to mention to the readers of this paper that all the mining journals, with this exception, are urging the creation of this bureau.

E. R. BUCKLEY.

Rolla, Mo., Jan. 28, 1910.

[It is a sound principle of political economy (not yet successfully controverted, although it is entirely foreign to ideas of paternalism and socialism) that a government should not undertake to do what its citizens can and ought to do for themselves; moreover, that a government should not enter into competition with its citizens. We admit that most governments have departed from this principle to various extents. The Prussian government, as a producer of a certain mineral, is a member of a cartel to regulate the business, control price, etc. Our own Government, through its Department of Agriculture, has joined the exchanges, boards of trade and private persons in the enterprise of collecting data on the growing crops, and has deliberately taken a hand in the game of speculation, or "gambling," which some characterize as a wicked thing, with the result that it would be a mighty good thing if the Department of Agriculture were to go out of this business.

The reference cited by Doctor Buckley to the work of the United States Geological Survey is not at all pertinent. This work, excluding the extraneous things with which lately it has been saddled, is something that the people cannot successfully do for themselves. The reasons are so obvious, it seems to us, that it is unnecessary for us to pause now to point them out.

As to the proposed bureau of mines, our position has been consistently as follows: We do not see any real need for it, and we can anticipate a good deal of vexation to the mining industry that might arise through bureaucratic interference under a loosely drawn bill (which the present proposal certainly is).

The regulation of mining under the police power, which is in all respects desirable, is wholly a matter of the States, and will be so until our Federal constitution is amended. A bureau of mines can do nothing in this direction except to act in an advisory capacity. This may be useful but it seems to us to be a narrow ground upon which to organize a bureau.

We believe that the United States Geological Survey has suffered from the diversion of its attention to irrelevant matters. We believe that the mining industry wants and needs more geology, and for upward of 25 years we have discouraged the adventures of the Survey into the field of technology, which has been successfully cultivated by the people themselves.

In discussing this subject two years ago we remarked that among the things that a bureau of mines might properly be expected to do are the following:

1. To collect statistics of production, number of men employed, wages, and in general such matters as are covered in the decennial census.

2. To investigate the dangers of mining and study precautionary measures.

3. To investigate and standardize methods of assaying and measurement.

4. To appoint and supervise the inspectors of mines in the Territories; to regulate and supervise the leases of the oil lands of the Indians in Oklahoma.

5. To represent the Government as the lessor in the event that legislation be enacted for the leasing of the reserved coal lands of the nation.

6. To investigate questions in which the prosecution of the mining industry affects the direct functions and rights of the Federal Government (such as hydraulic mining and the control of navigable streams; damage to forest reserves by smeltery smoke).

7. To test material required by the Federal Government for its own use.

8. To supply expert information to the post office, land office and other governmental services that may require it in the regular performance of their duties.

Practically all of this work is now being done by the Geological Survey. If by transferring it to a bureau of mines we can promote the efficiency of the Survey in its own domain, which we are quite sure is wanted by the people engaged in the mining industry, by all means let us have a bureau of mines, but let us limit it in the organic law so that it will not have any loop holes through which to embark upon irritating adventures. Under the bill that is now before Congress a bureau of mines can do almost anything from the identification of mineral specimens to the construction and operation of smelting works, limited only by the appropriation that it can extract from Congress. We have not had any reason to alter the opinions expressed in our editorial of Jan. 18, 1908.—EDITOR.]

Not a Billion Dollar Fraud

In the January number of McClures magazine there was an article on the coalfields of southern Alaska which asserts that they are worth a billion dollars, and that land grabbers have almost succeeded in getting possession of them by fraud. The article is important because, with its candid and impartial manner, it will mold the opinions of many. Does it in the main convey the truth?

That there is $1,000,000,000 of wealth in coal lying ready to hand in the Alaskan forest is a grotesque exaggeration. This false idea of the fabulous worth of the field constitutes not only an error of fact but the major premise of the reasoning. The irregularities in entry spoken of were in themselves comparatively small offenses, especially as there has been as yet no regular way provided for filing upon Alaskan coal lands. The essence of the presentation lies in an atmosphere of corruption and connivance mistily painted as a background to the vivid and startling richness of the prize.

The value of $1,000,000,000 (or more) is arrived at by multiplying an estimated tonnage of 2,000,000,000 by an estimated profit of 50c. per ton. This is claimed to be conservative because the "Government expert" put the profit at $1 per ton.

No coal, in Alaska or out of Alaska, is worth 50c. per ton as it lies in the seam. The highest-priced coal lands in the United States, lying in the anthracite regions of Pennsylvania and in the Connellsville coke district, are valued at no more than 5 to 10c. per ton of coal contained. This is a high rate due to tremendous local demand, unequaled mining and transportation facilities and the approaching exhaustion of the beds. Elsewhere in the United States developed coal land is worth, say, from 1 to 3c. per ton of coal in the ground, excluding all seams but the one actually mined upon. Undeveloped land without railroad connection is worth much less.

In distant places values are lower than in the nearby thickly populated localities. Thus the Crow's Nest Pass Coal Company, of British Columbia, which owns the greater part of about 22,000,000,000 tons of fine bituminous and anthracite coal, and which has coke ovens and mine works and a trade approaching 2,000,000 tons per year, is worth in the stock market only about half a mill per ton of coal owned.

The Alaskan beds have been opened up at a number of prospect holes, but it is idle to estimate from present knowledge the tonnage of workable coal. The seams have not been classified so that it can be told how many there are. Some of the openings disclose poor coal and a few good, the best so far discovered on the Pacific coast. Fortunately the finest coal is in thick seams 20 ft. or more where examined. The coal is friable, more or less crushed and usually dips steeply. The country is rugged and is also considerably faulted. The conditions of mining, even assuming the construction of the necessary railroads, would all be unfavorable; wages high, overburden heavy, pitch steep, climate rigorous and country inaccessible. Only one thing could make such coal lands of great or even ordinary value, and that is the existence of an unsatisfied neighboring market that will take whatever is mined and pay a high price for it.

The Pacific Coast market takes altogether about 5,000,000 tons of coal per year, principally from Nanaimo, Coos bay and across the Pacific. Fuel oil has taken the place of coal in California. This market is both small and competitive. Even assuming the Alaskan coals to capture a third or one-half of the total, the output would be only 4000 to 6000 tons per day; enough for two or three mines of moderate size. In order to capture any considerable share of the market some years of development must be entered upon, and some of the existing coal driven out by competition of price as well as of quality. The local market in Alaska will take little, say a few hundred thousand tons after the copper mines are opened.

Thus the Alaskan coal lands cannot be considered so valuable as the ordinary coal lands of fields with which we are more familiar. Instead of the coal being worth 50c. per ton in the ground including all seams, some one seam, in the few localities where it can most advantageously be opened, will be worth, at the most, one-half cent per ton, after development. The rest will be worth practically nothing.

The statement of values is therefore exaggerated 500 or 1000 times at least in the article in question. The figure of $1,000,000,000 for these small and distant, undeveloped fields would mean a value for the coalfields of the United States of over ten times what we have modestly claimed as the total of our national wealth. As a matter of fact prospective coal operations in southern Alaska are not of great economic importance except as they are a sign of the opening up of that country. The coal will be necessary to the railroads and to the copper industry.

Ignorance hastens to stir the pot of trouble. Where a deplorable controversy, wrecking men's usefulness, has been urged on its way by foolish exaggeration of the sort here met with, the truth needs no apology.

MORRELL W. GAINES.

Brooklyn, N. Y., Jan. 31, 1910.

American Institute of Mining Engineers

The 118th meeting will be held at Pittsburg, beginning March 1 next. Headquarters will be at the Hotel Schenley, and the meetings will be held in the lecture room of the Carnegie library. Harrison W. Cramer is secretary of the local committee; his address is at the Carnegie library, Pittsburg.

The annual business meeting of the corporation will be held at the office of the institute, 29 West Thirty-ninth street, New York, on Feb. 15, 1910, at 11 a.m. At this meeting, members present in person or by proxy will elect three directors of the corporation, and officers and members of the council, as required by the constitution. The following list comprises all the nominations received for officers and members of the council. For president of the council, D. W. Brunton, Denver, Colo.; for vice-presidents of the council, Benjamin B. Lawrence, New York; Albert Sauveur, Cambridge, Mass., Joseph W. Richards, South Bethlehem, Penn.; for councilors, Robert E. Jennings, New York; William Kelly, Vulcan, Mich., and Charles F. Rand, New York.

The subject of an institute excursion to Japan in the autumn of 1910 will be considered. The cost of the trip is estimated not to exceed $500 per person from San Francisco.

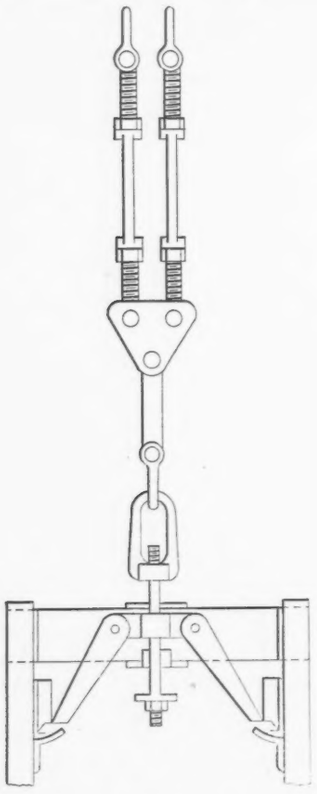
DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Readers of the JOURNAL are invited to contribute to this department. Articles should be brief, thoroughly practical, and preferably illustrated by drawings or sketches. Our draftsmen will prepare properly any kind of a pencil sketch that is intelligible. Something that is an old story in one district may be quite unknown in another. Articles accepted and published are suitably paid for.

Double Hoisting Cables

At the Beust shaft of the Deutschland mine at Hasslinghausen, Germany, the slipping of the cable is prevented by using a double rope running on double-grooved sheaves. Thus the bearing area on the packing in the sheaves is increased. As shown in the accompanying drawing, the cables are attached to the cage by a drawbar to which the cables are fastened by turnbuckles. These turnbuckles permit the strain on the cables to be equalized. Bolts prevent the moving of the turnbuckles by the twisting of the ropes.



DOUBLE HOISTING CABLE

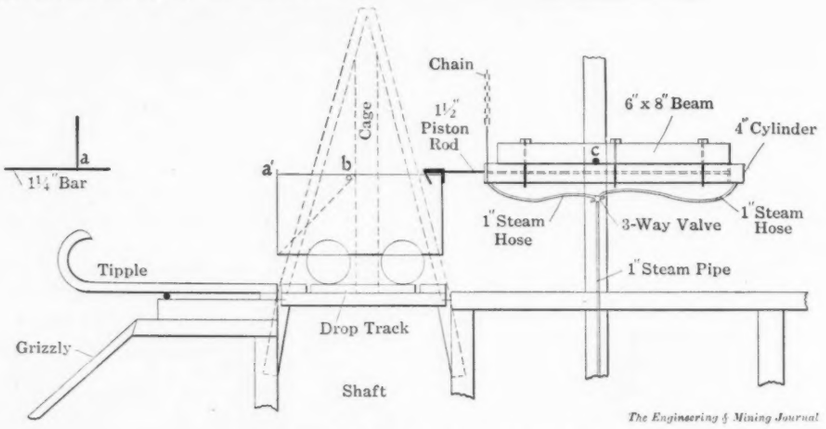
Steam Ram for Dumping Ore Cars

The accompanying illustration shows a steam ram that is used in moving ore cars from the cage to the tipple and dumping them. The cars with which it is being used are of 1½ tons capacity and are hoisted upon a cage that has a drop track, so that the cars are always in the same position in the cage. The drop track is lifted up by the chairs as the cage rests upon them. Surrounding the top of the shaft is a frame 3½ ft. high, and when the cage is down this frame is always in place, so there is no chance for a workman to fall in the shaft. As the cage approaches the top of the shaft the frame is carried on top of the cage, while the cage closes the mouth of the shaft.

There is one ram for each compartment of the shaft, and in this particular case one man operates both. In many cases two, and sometimes three, men are required to handle cars of this capacity, so that the use of the rams does away with one or two men. At the same time it is much safer, as there is no occasion for a man to step across the shaft, nor is there anyone working near the opening.

The man operating the ram is about 8 ft. from the shaft, and there is a guard rail between him and the shaft. As the car comes up the hook engages it automatically, all parts being so adjusted that the hook is always over the end of the car. The operator turns on the steam with a three-way valve, which opens an exhaust port at the same time. The car is pushed out by the piston to the tipple. A bar *a* engages the front of the car at *a'* and holds the hood in place, while the car tips and allows the ore to slide out the end. The hood is hinged at *b* and forms the end of the car. The piston cylinder is made of 4-in. steam pipe bored out to make it smooth. The end of the piston nearest the shaft is a little heavier than the other end, and for this reason is supported by a chain. The piston is fastened securely underneath a 6x8-in. beam which is supported between two posts on an axis *c* near the center. This allows the piston to move up or down at the car as necessary.

This apparatus has been in operation about three years at the Desloge Consolidated Lead Company's mines at Desloge, Mo., and was invented and patented by Thomas Fisher, who is the company's mechanical engineer.



STEAM RAM FOR DUMPING ORE CARS

Disposal of Tailings

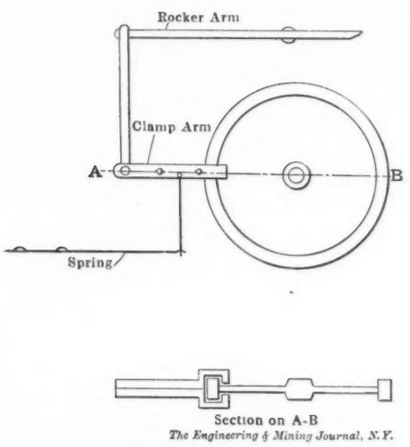
At the Oronogo Circle group of mines at Oronogo, Mo., the ground for the disposal of tailings is limited, and it became necessary to install a system of disposal which would not encroach upon other property, including railroad tracks. The scheme adopted consists of a track inclined at approximately 30 deg. upon which is operated a 2½-ton car, drawn by a cable from a small hoisting engine. The car is self-dumping, and it requires only one man to operate the car, as he loads the car and also attends to the engine.

The tailings are dewatered and run into a 100-ton bin from which they are drawn into the car. At present the car dumps at an elevation of about 50 ft. and when the pile is so high that the car will no longer empty itself, an additional bent is built on the trestle, which throws the tailings further over and at the same time higher.

The tailings being dry do not spread out to such an extent as when run out by water as is the regular practice in the Joplin district. In this case, the further the track extends, the higher it becomes, while in the usual method, the longer the trough, the lower the dump becomes.

Feeder Mechanism

Where old-style Challenge feeders have been in use for a long time it will pay to replace the disks and pawls with the single, simple disk shown in the sketch, provided, of course, the latest and best roller-clutch mechanism cannot be afforded. This scheme is in use at Bodie, Cal., and gives good satisfaction. The two-piece clamp arm, which is bolted to embrace the edge of the disk, is pulled and kept tight by the spring. As the rocker arm is raised by the feed collar on the stem, this clamp arm turns the feeder disk and through it the feeder plate, slipping back to its original position as soon as the rocker arm is released by the feed collar. The clamp arm fits loosely around the edge of the disk and gets its hold by pinching the rim on the up stroke.



FEEDER MECHANISM

Steam Stamps on the Rand

A steam stamp is being designed for submission to the Mines Trials Committee with the idea of attempting to do on the Rand what is done with steam stamps in the Lake Superior district in crushing copper ore. This equipment does not seem so desirable for crushing "banket," where amalgamation is insisted upon, as it does for silver ores where no amalgamation or concentration preliminary to fine grinding is required. The American steam stamp is best adapted for coarse crushing, from ⅜ to ⅝ in. size, and it is questionable whether 40-mesh crushing can be done advantageously by their use. If amalgamation after tube milling be adopted, the steam stamp might be acceptable.

Laboratory Balance Troubles

BY DONALD M. LIDDELL*

In those laboratories where the balances cannot be supported on proper stone piers, trouble is often experienced from the jarring to which they are subjected. This can be eliminated, in great measure, by supporting the balance legs on truncated pyramids cut out of old rubber packing, the lower base of the support being about 2 in. square and the upper base about 1, the thickness also about 1 in. A small square of ground glass should be cemented to the top of each piece in order to take the direct thrust of the balance legs. These truncated pyramids give a much better support than an equal amount of rubber in the form of a rectangular prism as there is not the same tendency to oscillation.

Another variation of the same idea is to bore four holes about ½ in. deep in the table on which the balance stands and insert No. 5 rubber stoppers, placing on top of these a lead plate upon which the balance rests. The lead plate, if of the proper size, completely deadens any motion due to accidentally touching the balance, while still leaving enough spring in the rubber to deaden any external vibrations. By experiment it was found that the best results seemed to be obtained with a 225-lb. lead plate with small holes bored in it so that the balance legs were sunk about 3/16 in. below the surface. This obviates any tendency of the balance to slip and still allows sufficient play in the set screws to adjust the balance. The above is the suggestion of A. E. Knorr.

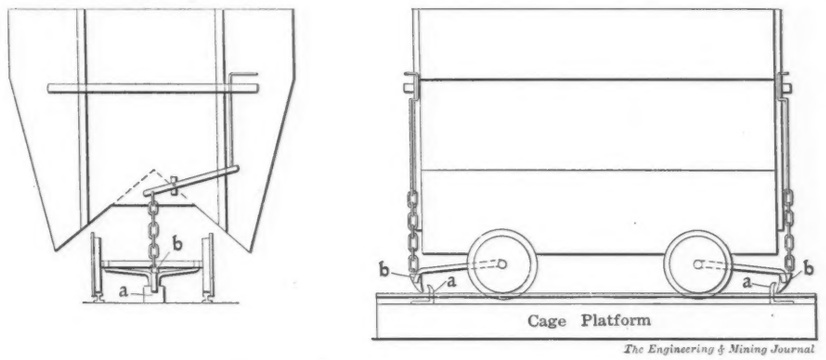
Occasionally delicate gold balances will be found which seem to be subject to disturbances from the mere approach of a person, apart from any jarring of the floor due to such cause, or even from movements of the operator's hands. It has been my experience that these balances usually have had pans blackened on one side and bright on the other. The only apparent explanation is that there is some action analogous to that of the vanes in a Crooke's radiometer. However improbable as this may seem, the behavior of two balances affected this way has been greatly improved by the substitution of pans blackened both inside and out.

*Grasselli, Ind.

Car Locking Device

Cars should always be locked on a cage in hoisting, this being best accomplished by having iron straps hinged on the frame of the cage which are pulled down when the car is on the platform, holding it firmly in position. The car-locking device here illustrated may also be used on any cage.

On the cage platform two plates, bent as shown at *a*, are placed to engage hooks *b* suspended from either end of the car. These hooks are hung from levers by chains and pivoted from the car axles. When the car is run on the cage the hook on the front of the car passes over both catches but the rear one engages and the car is firmly locked in position.



CAR-LOCKING DEVICE IN OPERATION

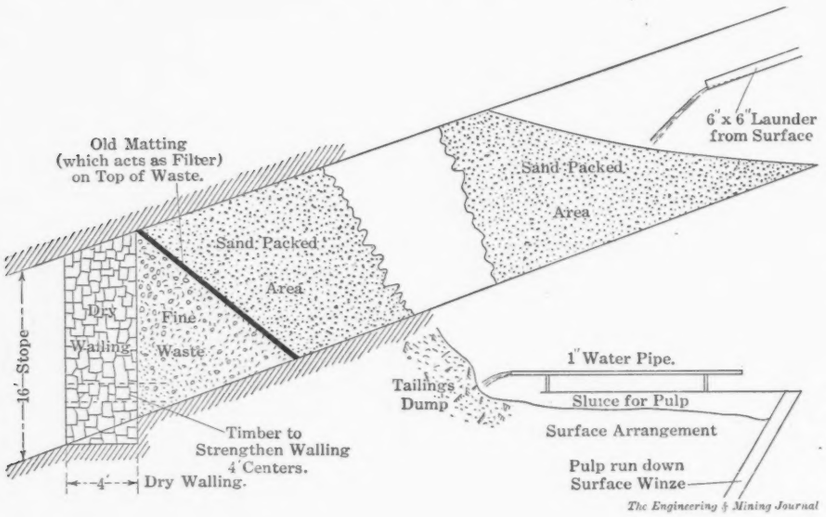
Lime for Cyanide Plants

W. A. Caldecott has called attention to a serious defect in the lime which is ordinarily supplied to cyanide plants. Much of it, burned in open kilns, contains partially burned coal or wood, either of which is a good precipitant of gold and silver. Where lime burned in retorts is not available, that fed to the plant should be in the form of a solution or as a thin emulsion. A discovery usually made at every cyanide plant during its life is that wood ash can be used to replace lime for neutralizing acidity. It is not always fol-

lowed by the discovery, however, that the ash should be leached rather than fed into the pulp, on account of the precipitation caused by the unburned charcoal.

The Spuelversatz Method of Hydraulic Filling

As a solution of the problem of preventing the extensive caving and subsidence of the worked-out areas underlying the battery at the Robinson mine, Transvaal, experiments were made with a view to testing the utility of the Spülversatz method (water flushing),



METHOD OF FILLING STOPES WITH TAILINGS

and the *Min. Journ.* says that from present appearances the system is highly successful and likely to be generally adopted on the Rand. Briefly, the work as done on the Robinson consists in sluicing the sand of the tailings dumps into a 6x6-in. launder, which conveys the pulp underground to the stope to be supported. The bottom of the stope is dry walled (see sketch); on the walling fine waste is placed, which in turn carries old matting from the cyanide tanks. This matting acts as a filter. Other dry walls at right angles cut up the stope into panels for the reception of the incoming pulp, the sands quickly settle, and the water filtering away through the walls is pumped back to the surface and re-used. The proportion of water to sand is 1 to 2, the gradient of the launder being 10 to 15 deg. A small quantity of lime is added to maintain alkalinity. The cost works out at 2.1d. per ton, and from 80 to 100 tons are sent underground daily. The sand sets hard and compact in two or three days, and the crush is, approximately, 10 per cent.

Determination of Small Quantities of Copper in Slag

BY C. A. HEBERLEIN*

The quick determination of very small quantities of copper in irony slags offers extreme difficulty, particularly when very high in iron as in slags made in pyritic smelting. While blowing in the plant of the Maine & Nebraska Mining Company at Balsas, Guerrero, Mexico, the ore proved to be ideal for pyritic smelting, but the content of copper was so low—averaging about 0.3 per cent.—that I became interested in the actual loss of copper in the slag.

The chemist reported "no copper in the slag," which I knew could not be true. During the short run I supervised, the copper concentrated from 2.5 to 4 per cent. in the matte, determination thereof being made by the current smeltery method, precipitating the copper with H_2S, but I found the following method quicker, easier to handle and just as accurate:

Five grams of chilled slag are boiled in hot water, enough HCl added to thoroughly decompose the slag, then HNO_3 and KNO_3 are added and all run to dryness and with H_2SO_4 to fumes. After cooling, hot water is added, then more H_2SO_4 and boiled, the solution then being poured off on a quick-acting filter and the residue boiled again with water, and again filtered. The filtrate is then brought to boiling, and addition of a few grams of crystalline hyposulphite is made, precipitating the copper very rapidly. After filtration, the copper sulphide is ignited in the front of the muffle in a porcelain crucible. Then the copper is dissolved in 5 c.c. of HNO_3 neutralized with NH_4OH and titrated with potassium cyanide solution (0.25 per cent.) in the presence of an excess of 3 c.c. of NH_4OH, the same amounts of acid and ammonia being used in standardizing the cyanide solution.

I found the results to be good and the method more convenient than the H_2S method. If 0.25 per cent. cyanide solution is used and the assay is over-titrated, say 0.1 c.c., the error would still be very small. For example, if the copper ran 0.086 per cent., requiring on a 5-gram charge and 0.25 per cent. solution, 1.72 c.c., or 0.43 per cent. copper, deducting therefrom 0.1 c.c., or 0.025 per cent. copper, would give for the correct contents

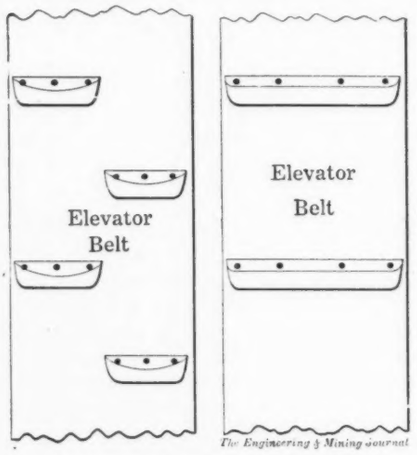
$$0.430 - 0.025 = \frac{0.405}{5} = 0.081$$

per cent. copper instead of 0.086 per cent., or expressed per ton of slag 0.05 kg. metallic copper, which is small enough to be neglected.

*Metallurgical engineer, Campo Morado, Guerrero, Mexico.

Staggering Elevator Buckets

The life of elevator belts may be considerably prolonged by staggering the buckets as shown in the accompanying illustration. The Continental Zinc Company of Joplin, Mo., has been using this scheme for a number of years. The belts used are 20 to 24 in. wide and in place of using buckets reaching the entire



METHOD OF STAGGERING ELEVATOR BUCKETS

width of the belt, buckets half as long are used and placed alternately on the belt as shown in the accompanying illustration. Of course this necessitates practically the same number of holes in the belt, but they are so distributed that the line of holes does not extend entirely across the belt. Again the load is not so heavy at any one point on the belt. In case the belt wears so much that it is necessary to shift the buckets, they are moved about half the distance to the next bucket, and at no time does a row of holes extend entirely across the belt.

January Dividends

The accompanying table shows the amount per share and total amount of the dividends paid during January, 1910, by a number of mining and industrial companies in the United States, Canada, South and Central America.

U. S. Mining Companies.	Situation.	Amt. per Share.	Amt. Paid.
Alaska Mexican, g.	Alas.	$0.60	$108,000
Alaska Treadwell, g.	Alas.	1.00	200,000
Boston & Mont., c.	Mont.	3.00	750,000
Bunker Hill & Sull., s.l.	Ida.	0.15	45,000
Goldfield Con., g.	Nev.	0.30	1,067,510
Iron Silver	Colo.	0.10	50,000
Jamison, g	Cal.	0.02	7,800
New Idria, q	Cal.	0.30	30,000
Portland, g	Colo.	0.02	60,000
Silver King Co't'n.	Utah	0.15	187,500
Standard Con., g.s.	Cal.	0.75	133,795
Tonopah of Nev., s.g.	Nev.	0.35	350,000
United Verde, c	Ariz.	0.75	224,945
Utah Con., c	Utah	0.50	150,000
Vindicator Con., g	Colo.	0.03	45,000

U. S. Industrials.	Situation.	Amt. per Share.	Amt. Paid.
Am. Cement	Penn.	$0.10	$20,000
Am. Sm. & Ref., pfd.	U. S.	1.75	875,000
Am. Sm. & Ref., com.	U. S.	1.00	500,000
Cent. C. & C., com.	Mo.	1.50	76,875
Cent. C. & C., pfd.	Mo.	1.25	23,437
Consolidation Coal	Md.	1.50	285,370
Del., Lack. & Western Coal	U. S.	2½%	
Empire S. & I., pf.	N. J.	1.50	37,500
General Chem., pf.	N. Y.	1.50	150,000
National Lead, com.	N. Y.	1.25	186,292
Republic I. & S., pfd.	Ala.	1.75	357,295
Sloss Sheffield, pf.	Ala	1.75	117,250
Va. Car. Chem., pf.	U. S.	2.00	360,000

Foreign Mining Companies.	Situation.	Amt. per Share.	Amt. Paid.
Ajuchitlan M. & M.	Mex.	$0.02½	$12,500
Buffalo, s	Ont.	0.05	50,000
Crown Reserve, s.	Ont.	0.15	262,500
Dominion Coal, com.	N. S.	1.00	150,000
Esperanza, s.g.	Mex.	0.24	109,200
Guanajuato Dev., s.	Mex.	3.00	30,000
Guggenheim Expl.	Mex.	2.50	262,500
Hedley, g.	B. C.	0.30	36,000
La Rose, s	Ont	0.10	149,850
Lucky Tiger, g.	Mex.	0.05	37,500
McKinley-Darragh, s.	Ont.	0.05	112,384
Nipissing, s	Ont.	0.37½	450,000
Temiskaming & H. B.	Ont.	3.00	23,283
U. S. St. & Coal, com.	U. S.	1.00	60,000

Chronology of Mining for January, 1910

Jan. 1—Floods destroyed 100 miles of the Salt Lake-Los Angeles railroad in Nevada, greatly impeding mining.

Jan. 8—Annual statistical number of the JOURNAL issued.—Fire destroyed warehouses and stores of Dolores company at Madera, Chihuahua, Mexico. Loss $100,000.

Jan. 13—Pearl Consolidated mine, Idaho, sold to J. H. Harper of Spokane, Wash., for $225,000.—News received of death of Harry S. Elliott, of Elliott-Hubbard Copper Company, of Chicago, and H. C. Greer, of Seattle, Wash., in snowslide, Dec. 30, in Alaska.

Jan. 14—Payment in full of 500,000 pesos made by Marcus Daly estate for Cinco Minas property in Jalisco, Mexico.

Jan. 15—Homestake mine resumed partial operations with nonunion men, the principal mines of district adopting card system.

Jan. 17—W. P. Hammon and others took a bond on 7000 acres of dredging ground on Clear creek, six miles south of Redding, California.

Jan. 23—Mill of Wasp mine at Lead, S. D., burned. Loss, $97,000.

Jan. 26—Payment of 9,000,000 pesos made by the Camp Bird, Ltd., of London, for the Santa Gertrudis mine in Hidalgo.

Jan. 26—E. A. Wall's injunction against Utah Copper Company dissolved and merger of Utah Copper Company and Boston Consolidated consummated.

Jan. 27—Announcement of call of special meeting of the Anaconda Copper Mining Company, March 23, to consider increasing the stock from 1,200,000 shares, par $25, to 6,000,000 shares to effect a merger of Butte properties.

Jan. 29—A fire damaged the shaft of the Goldfield Consolidated at Goldfield, Nev., to the extent of $60,000.

Jan. 31—Explosion in coal mine at Primero, Colo., results in large life loss.—Directors of Nevada Consolidated Copper Company vote to submit proposed merger with Utah Copper Company to a vote of the stockholders.

American Smelting and Affiliated Companies

The statements of the "Guggenheim companies," just issued, are herewith reproduced. The earnings of the American Smelting and Refining Company were at the rate of about 6½ per cent. per annum on the common stock during the half-year under review, ended Oct. 31, 1909. The American Smelters Securities Company earned during the half-year ended Nov. 30, 1909, on the basis of 7 per cent. annually on its common stock, and Daniel Guggenheim anticipates that future earnings will be increased. The American Smelting and Refining Company owns about 60 per cent. of the common stock of the Smelters Securities company.

AMERICAN SMELTING AND REFINING COMPANY.

PROFIT AND LOSS STATEMENT.

	Six Months Ended Oct. 31, 1909.	Six Months Ended Oct. 31, 1908.
Net earnings from operations	$3,442,193	$3,917,683
Deduct construction and improvements	48,774	75,922
	$3,393,419	$3,841,761
Dividends preferred 3½%	$1,750,000	$1,750,000
Dividends common, 2%	1,000,000	1,000,000
Total dividends	$2,750,000	$2,750,000
Net surplus to profit and loss	$643,419	$1,091,761

STATEMENT OF ASSETS AND LIABILITIES.

Assets.	Oct. 31, 1909.	Oct. 31, 1908.
Property	$86,845,671	$86,845,671
Investments	4,368,191	2,858,617
Metals (refined values)	16,207,043	18,218,785
Material	1,224,605	1,249,561
Net current assets	592,716	
Cash and demand loans	9,445,379	8,629,550
Total	$118,683,605	$117,802,184
Liabilities.		
Capital stock	$100,000,000	$100,000,000
Bonds (O. & G. Sm. Co. 1st Mtg.)	237,000	349,000
Net current liabilities		804,645
Unearned treatment on metals in process	2,551,917	2,148,559
Profit and loss	15,894,688	14,499,980
Total	$118,683,605	$117,802,184

AMERICAN SMELTERS SECURITIES COMPANY.

PROFIT AND LOSS STATEMENT.

	Six Months Ended Nov. 30, 1909.
Net earnings from operations	$2,490,526
Deduct construction and improvements	186,999
	$2,303,527
Less dividends	1,260,000
Net surplus to profit and lost	$1,043,527

STATEMENT OF ASSETS AND LIABILITIES.

Assets.	Nov. 30, 1909.	May 31, 1909.
Property and investments	$78,846,077	$78,846,077
Metals	10,265,102	6,964,093
Material	1,049,890	984,527
Cash	703,881	1,285,335
Total	$90,864,950	$88,080,032
Liabilities.		
Capital stock	$77,000,000	$77,000,000
Net current liabilities	8,307,258	6,418,999
Deferred liabilities	2,360,640	2,557,360
Unearned treatment charges	1,598,773	1,548,921
Profit and loss	1,598,279	554,752
Total	$90,864,950	$88,080,032

In the statement of the Guggenheim Exploration Company, dated Dec. 31, 1909, all of the items are carried at cost, the nominal value of $1 being assigned to a par value of $11,249,000 of Smelters Securities common stock. Mr. Guggenheim places the total value of Guggenheim Exploration Company stock outstanding (207,933 shares) at $65,500,000, or $315 per share. The present net earnings, based on the dividend disbursements of the subsidiary companies, are stated to be on the basis of 14.7 per cent. per annum. The surplus was increased $213,375 over that of a year ago.

During the year the Exploration company converted its holdings of Cumberland-Ely stock and Nevada Northern Railway bonds into Nevada Consolidated stock. This stock was placed on a divi-

GUGGENHEIM EXPLORATION COMPANY.

Assets.	December 31, 1909.
Treasury stock	$1,206,700
American Smelters Securities Co. (A)	13,860,000
American Smelters Securities Co., common	1
Other properties and investments	19,149,552
Furniture, fixtures and equipment	6,936
Bills and accounts collectible	1,170,801
Cash and demand loans	1,463,075
	$36,857,065
Liabilities.	
Capital stock	$22,000,000
Bills and accounts payable	1,000,000
Surplus	13,857,065
	$36,857,065

dend basis during the last quarter of the year, the initial dividend being 37½c. per share quarterly, 30 per cent. of the par value. Yukon Gold commenced dividends during the third quarter on a basis of 8 per cent. per annum. All the Guggenheim copper companies are now issuing quarterly statements to the stockholders.

The item "Other Properties and Investments" in the assets of the Guggenheim Exploration Company is detailed as follows, all items being carried at cost: Esperanza, $322,347; Nevada Consolidated, $4,234,408; Utah Copper, $4,788,648; Yukon Gold, $9,794,639; miscellaneous investments, $9510.

Official Views of the Proposed Merger of Utah Copper and Nevada Consolidated

At the meeting of the directors of the Nevada Consolidated Copper Company in New York, Jan. 31, 1910, Pope Yeatman, consulting engineer, submitted a report in which he said: "I strongly advise the stockholders of the Nevada Consolidated Copper Company to accept the offer of the Utah Copper Company. My chief reason for making this recommendation is that I believe that after two years, during which time the concentrator of the Utah company is to be increased from 8000 tons to 12,000 tons daily, and the Boston concentrator from 2750 tons to 6000 tons per day, and necessary advance stripping of overburden and railway improvements made to insure delivery of such increased tonnage for the plants, the annual profits to be distributed per share of Nevada Consolidated stock exchanged will be materially greater than would be the case if the stockholders retained their Nevada Consolidated stock and depended upon the profits of that company, and that these increased earnings will extend over a much greater period of time."

This takes into consideration an increase of the Utah company's capitalization to 2,500,000 shares with a par value of $10 per share, and is based on exhaustive consideration by Mr. Yeatman of the physical and technical aspects of the Utah Copper Company's property.

It is said that considerable friction between the opposing factions developed at the meeting. The Guggenheim directors voted favorably on the merger proposal, but owing to bitter opposition, it was finally determined to lay it before the shareholders without official recommendation. After the meeting President James Phillips, Jr., of the Nevada Consolidated company, issued a statement in which he said:

"The meeting of the directors was called by the Utah interests in the board for the purpose of taking action on the letter of the Utah company making an offer for exchange of stock. Consistent with what I believe to be for the interests of the Nevada stockholders, I voted against the proposed action. It seemed to me a subtle and unfair method of procedure, and especially unfair to Nevada stockholders because supported by four of our directors who are directors of the Utah company, also one of our directors who has been acting as counsel for the Utah, one who is auditor for the Utah, and two others who are employees of the Guggenheim interests."

On Feb. 3, President Phillips specifically denied that the Guggenheim interests controlled 50 per cent. of the Nevada Consolidated stock and stated that he had notified the members of the Nevada Consolidated board who were interested in the other companies in the proposed deal that he would challenge their right to act on the proposal of the consolidation.

The Greater Anaconda Company

The shareholders of the Anaconda Copper Mining Company will vote, March 23, on increasing the capital stock from $30,000,000 to $150,000,000. Part of the new stock to be issued is for the purpose of acquiring the property of certain Amalgamated and Cole-Ryan companies in the Butte district, among which are the following: Anaconda Copper Mining Company, Boston & Montana Consolidated Copper and Silver Mining Company, Butte & Boston Consolidated Mining Company, North Butte Mining Company, and Butte Coalition Mining Company. The official announcement says in substance:

"The 'law of the apex,' or the right to follow a vein on its dip extra-laterally beyond the surface lines of a mining claim, prevails in Montana, and has given rise to many perplexing problems; it was this law that was chiefly responsible for the costly Heinze-Amalgamated litigation, which was finally terminated some years ago only by the purchase of the Heinze properties and the subsequent formation of the Butte Coalition Company.

"The mining claims of the Anaconda Copper Mining Company and of the other companies affected by this plan are all located upon the Butte hill within a comparatively circumscribed area, and are so closely and inextricably interlaced as to make almost impossible the segregation of the ownership of the underground orebodies.

"Some of the operating features which have been considered in favoring the proposed plan are the economies which will result from working all the mines in accordance with a general system of ventilation, drainage and development, thus relieving the owners from the necessity of maintaining numerous expensive surface and underground plants which under separate ownership are essential for working the scattered properties of the different companies.

"The Anaconda company is regarded as the logical company to become the purchaser of the properties of the other companies, and the step taken at the recent board meeting was the first toward submitting the matter to the stockholders of the different companies. It is not likely that all of the increase of stock, if authorized, will be used at present in carrying out this plan."

Recent Coal Mine Explosions

The coal-mining industry in America seems to have entered another danger period, as is shown by the latest mine disasters. The first of these explosions took place in the Nottingham colliery of the Lehigh & Wilkes-Barre Coal Company at Plymouth, Penn., Jan. 11, 1910. This accident was due to the firing of a body of gas that had accumulated in two abandoned chambers. This accumulation of gas was due to the breaking down of a check door by a fall of roof, which took place about 16 hours before the explosion occurred. The verdict of the coroner's jury disclosed that the fire boss was negligent in his duty in not notifying the men who were working in this section of the mine, before the air current was tampered with. It was also shown that the assistant mine foreman was negligent in his duty in leaving the check door down for so long a period before having it repaired.

Probably the most important finding of the jury in connection with this explosion was that the certificates of competency of two of the deceased miners were fraudulent and were irregularly issued. This question of fraud in the issuance of miners' certificates is a dangerous practice and a violation of the mine laws that should be immediately corrected for once and all. The existence of this evil has been known for years to the higher State officials, and that corrective measures have not been applied before is an evidence of incompetency or negligence on the part of those responsible for an observance of the State mine laws.

The second important explosion in the recent series occurred in one of the mines of the Colorado Fuel and Iron Company at Primero, Colo., Jan. 31. This accident resulted in the death of about 79 miners and was said to be due to an explosion of gas in the main slope of the mine. It has been stated that safety lamps were used in the Primero mine.

Following the two explosions just mentioned, another similar accident has been reported in the Browder mine, 1½ miles from Drakesboro, Kentucky, Feb. 1. The explosion at the Browder mine was said to have been caused by gas, and at least 30 miners have perished.

Charles B. Parsons

Charles B. Parsons, superintendent of the St. Joseph Lead Company, died at his residence at Riverside, Mo., Jan. 28, 1910. He was born at Benson, Vt., Feb. 26, 1836, and received his education in the public schools of Michigan, where his parents moved while he was yet a boy. He practiced dentistry for awhile but joined the Fourth Michigan Volunteers as a lieutenant on the breaking out of the Civil War and saw active service in the McClellan campaign. At the close of the war he took charge of a small silver-lead mine at Northhampton, Mass., whence he went to Missouri about 1867. Since that time, for nearly 43 years, he had been the superintendent and resident manager of the St. Joseph Lead Company, and the credit of its upbuilding and great success is largely due to him.

When he took charge of the property in 1867, it was but little better than a gopher-hole operation with some hand jigs, and its annual output was scarcely 100 tons. He promptly recognized that if the property had a future, it was in abandoning surface work and in opening up deep mining. He at once secured the only diamond drill in the country—a Lechaux drill that had been imported from France—which had done a little drilling in the red-slate district of Vermont. While it was a very crude affair, it was able to drill about 200 ft., and it demonstrated the occurrence of the large bodies of disseminated lead which have since been so great a source of profit to this company and have made this the leading lead district in the United States. With the discovery of the disseminated lead his real troubles began, as the company had no money nor credit and the nearest railroad point was 10 miles distant, with wretched roads intervening—certainly a most discouraging state of affairs to open up a low-grade property. With indomitable grit and energy, that tolerated no such word as failure, Mr. Parsons began the tedious, laborious work of developing the property. In the years of hard work that followed, a little mill was slowly evolved after many experiments and trials of all kinds of ore-dressing machinery. The payroll was the most serious obstacle to meet and it was frequently six months or more in arrears, and usually had to be paid in store orders. Mr. Parsons' energy and confidence inspired a wholesale grocer in St. Louis to ship him groceries on credit, but when the goods arrived, the company was unable to secure them as it had no money to pay the freight. A local friend was prevailed on to advance the money and in this precarious manner the company existed for several years. A large foundry in St. Louis was induced to take stock and notes for the machine supplies, but when it was necessary to raise $1000, to buy a boiler, as the boilermaker would only take the order with the cash in advance, Mr. Parsons went around the community and borrowed the amount in lots of $5 and $10.

With the assistance of the neighboring Desloge Lead Company, a narrow-gage railroad was built—or rather laid—in 1880 from the mine to the Iron Mountain road, at Summit, and this put the company "on the map." The hundreds of teams that labored over the wretched hilly roads in hauling supplies in and lead out at 500 to 1000 lb. per trip, were dispensed with. The railroad was on the top of a ridge, which it followed closely with all its sinuosities, hollows and summits, and while seldom the 13-mile trip was made without running off the track, or having to double with a 3-car train, it put actual dividends in sight. When the pioneer mill—which was largely a museum of mill machinery and patched-on annexes—burned down in 1883, Mr. Parsons feared that his struggling company had received a death-blow. But his indomitable courage and energy, his ability to succeed under conditions that would have disheartened any other man and his faith in the property at last won recognitation. One of the largest banks in St. Louis was only too glad to give him credit for building a new mill. From that time he enjoyed relatively smooth sailing in the financial seas and the company began to prosper. He boldly erected a 500-ton mill which at that time was regarded as a giant. It was built on entirely new lines and had many features that were not only original, but meritorious. He made valuable improvements in the Rittinger table and developed the Parsons' under-piston jig, that requires a minimum of space and attention.

Before Mr. Parsons recently turned over the details of office to his son Roscoe, the holdings of the company had increased to over 20,000 acres; seven mines were in operation that supplied two mills of 1500 tons daily capacity each; it had the largest lead smelter in the Mississippi valley. The little narrow-gage road was replaced by 75 miles of well built, standard-gage railroad and the annual output exceeded 30,000 tons of lead. After paying for these improvements and building the large model towns of Bonne Terre, Herculaneum and Leadwood out of part of the profits, over $6,000,000 has been distributed in dividends and the stock sells on the open market at such a high rate as to yield only 4½ to 5 per cent.; a most excellent value for a mining stock.

In 1862 Mr. Parsons married Miss Jane Doolittle, of Canada, who survives him. He had eight children, five of whom are living and will inherit a more than comfortable competence.

The Bureau of Mines Bill

SPECIAL CORRESPONDENCE

After a long and tedious debate the House of Representatives, on Tuesday, Jan. 25, passed the bill for the establishment of a Bureau of Mines. This bill is the same that was reported some time ago from the committee on mines and mining of the House as a substitute for all the other mining-bureau bills that were pending before the committee and was on the calendar as H. R. No. 13,915. The bill was passed with some minor amendments in the form in which it was reported from the committee and in which it has already been fully described in this correspondence. The final vote was not recorded and the passage at the last took place in a routine way.

The measure has now gone to the Senate where it has been referred to the committee on mines and mining in that body. No meeting of the committee has been held since the passage of the measure by the House but one is expected to occur in the near future. A meeting had, however, been held shortly before the action of the lower chamber and at that time a discussion of the measure, forecasting its passage by the House, was engaged in. There is a difference of opinion among the members of the committee with respect to the measure although up to date, it is stated, there is no active and persistent opposition so far as known. The chairman of the committee, Senator Dick, of Ohio, states that it is his earnest desire to report and pass the bill at the earliest moment. Democratic members of the committee are senators Hughes, of Colorado, Johnston, of Alabama, Tillman, of South Carolina, and Gore, of Oklahoma. It is the general belief that there will be some delay in getting any report from the committee and still more serious delay in getting action one way or the other upon the floor of the Senate.

The debate in the House developed the sources of opposition to the Bureau of Mines bill in that body and there will be antagonism of the same sort in the upper house. One chief source of opposition was found among those who believe that the measure is a useless expense to the Government in view of the fact that the work supposed to be actually necessary in connection with mining is now being done in the technologic branch of the Geological Survey.

A second serious group of opponents is found in those who believe that the proposed bureau is merely an entering wedge thrust in by a group of boomers who want to get a department of mines established and who are desirous that the Government shall do work that ought to be done at private cost by the interests

for whose benefit the work is undertaken. Mr. Slayden, of Texas, put this point.

A third source of opposition is seen in the attitude of the Southern congressmen who believe that the proposed bill transcends the scope of the powers of the Federal Government and invades State rights. This position was urged by various representatives.

The Tariff on Scrap Iron

SPECIAL CORRESPONDENCE

Assistant Secretary Curtis of the Treasury Department has, with the approval of Secretary McVeagh, practically reversed the scrap-iron ruling which has been giving so much anxiety to New England manufacturers. He has sent, under date of Jan. 28, the following letter to the collector of customs at Philadelphia, in which is contained the new interpretation:

"Since the publication of the department's instructions of Oct. 23, 1909 (T. D. 30063), relative to scrap iron and scrap steel, the department has received many requests from persons interested in the business of remanufacturing these commodities for further consideration thereof.

"In determining the interpretation to be placed upon paragraph 118 of the Tariff Act of 1909, the important point to be borne in mind is the intention of the Congress, as indicated by the change in the rate of duty upon scrap from $4 to $1 per ton. It is not only a matter of common knowledge, but also within the specific knowledge of the department that Congress intended scrap iron and scrap steel to be imported with a duty of $1 per ton; and that Congress did not intend to permit the entry as scrap, of iron and steel not really waste or refuse. In order to give full effect to the primary intent of the statute, i.e., the lowering of the tariff on scrap, the defining clause must be interpreted in a manner that will not render nugatory the principal clause immediately preceding it. In other words, a proper and just construction demands that more stress be laid upon the clause by which the duty is lowered than upon the clause excepting certain materials from the operation of the paragraph. The department is of opinion that the phrase, 'fit only to be remanufactured by melting and excluding pig iron in all forms' was intended by Congress to be a more accurate definition of the term 'scrap iron and scrap steel' than was contained in the act of 1897, and was not intended in any way to be a further limitation thereof.

"After a careful investigation into the methods of remanufacturing waste or refuse iron or steel now in operation, the department is of opinion that all scrap iron and scrap steel is dutiable at $1 per ton except such as can be profitably remanufactured by a process of rolling, hammering or cutting, or any other process which does not include the complete change of form of the material by fusion caused by the application of heat.

"T. D. 30063 is hereby modified accordingly."

The Anthracite Trust Suits

The Government brief in the case against the alleged "Anthracite Trust," which was filed recently in the United States Circuit Court at Philadelphia, is a voluminous document. Besides the general charges of confederation in restraint of trade and of monopoly, there are nine specific acts of which complaint is made. These charges are summarized as follows:

SPECIFIC COMPLAINTS

(1) The interests of the defendant railroad companies in anthracite-coal land and in coal-owning and producing companies acquired since Jan. 1, 1874, are held in violation of the constitution of Pennsylvania.

(2) Railroads engaged as defendants in transporting coals of the same kind from a restricted area of production to the principal market are competitive, although their tracks may not reach the same mines.

(3) The evidence establishes that all the defendant railroads and their coal companies are parties to a combination and conspiracy to stifle competition and create a monopoly of trade and commerce among the States in anthracite coal, in violation of the anti-trust act.

(4) The 65 per cent. contracts, so-called, suppress competition among the coal companies of the defendant railroads in the purchase of coal from independent producers, and in the sale of coal to the public, remove such independent producers as competitors of the railroad coal companies in the sale of coal to the public and restrict their output at the will of the latter; prevent competition for the transportation of the independent output, either among the defendant railroads or by any new railroad, and by operating to give a preferential freight rate prevent the independent output not sold to the railroad companies from getting to the leading market on equal terms: which is, all in violation of the anti-trust law.

(5) The exchange of shares of the Erie Railroad Company for shares of the New York, Susquehanna & Western created a combination in restraint of commerce among the States.

(6) The acquisition by the Reading Company, while owning all shares of the Philadelphia & Reading, of a majority of shares of the Central Railroad of New Jersey, created a continuing combination.

(7) The Temple Iron Company is a combination in restraint of trade.

(8) The acquisition by the Erie Railroad Company of all shares of the Delaware Valley & Kingston, a projected competing carrier, and all shares of the Pennsylvania Coal Company, created a combination.

(9) The acquisition by the Lehigh Valley Railroad Company of all shares of Coxe Brothers & Co., the only remaining important competitor of the Lehigh Valley Coal Company, constituted a combination.

THE TEMPLE IRON COMPANY

Paragraph 7 requires some explanation to those who are not familiar with the anthracite situation. The Temple Iron Company is a small concern owning a blast furnace and one or two small collieries. Apparently there is no occasion for frequent meetings of the board. But all the directors are presidents of anthracite-carrying railroads, and the board meets at short intervals. The charge is that these meetings, which are not necessary to attend to the nominal business of the company, are simply a cover for conferences of the members of the alleged trust.

International Asbestos Association

The International Asbestos Association was recently organized at a meeting held in New York. Its membership is composed of representatives of American and Canadian mine owners and manufacturers. The interests at the meeting represented between 80 and 90 per cent. of the asbestos business in the United States and Canada, and included the largest producers and users of asbestos in those countries, such as the Amalgamated Asbestos Corporation, Ltd., Keasbey & Mattison Company, Philip Carey Manufacturing Company, Asbestos Protected Metal Company, Franklin Manufacturing Company, H. W. Johns-Manville Company, Sall Mountain Asbestos Manufacturing Company, Ling Asbestos Company, and the United States Asbestos Company. The aggregate capitalization of the concerns so far represented is over $40,000,000. The following were elected officers of the association: T. F. Manville, president; R. V. Mattison, Jr., vice-president; R. P. Doucet, secretary.

It is announced that the purposes of the association are the general exploitation of the uses of asbestos, particularly in the field of fireproof construction, cooperation between consumer and producer, cultivation of new markets and development of processes whereby the wastes in the industry may be rendered commercially valuable. The association will establish a bureau that will be devoted to the aforementioned purposes.

Equipment and Methods at the Hecla Mine

This Coeur d'Alene Mine Developed by Levels at 300-ft. Intervals; Stull Timbering in Overhand Stopes; Ilgner Electric Hoisting System

BY ROY HUTCHINS ALLEN*

The Hecla mine at Burke, Ida., has attracted little attention in the mining press, yet it is one of the most important of the Cœur d'Alene district and has a record of which any mine might well be proud. The equipment and method of mining are unusual, and alone merit a description of this splendid mine.

Geology of the Deposit

The country rock at the mine is the sericitic Burke quartzite, which has a strike nearly northwest, and a dip of about 80 deg. to the northeast. The rock is distinctly bedded and in places, as near the railway station at Wallace, shows well developed ripple marks. On account of its thin platy structure and the presence of the many fine scales of muscovite mica, or sericite, the rock has at a short distance the appearance of a shale, and it is only in the fractures across the bedding that its hard compact character is seen.

The Hecla lode is a true fissure vein which is almost parallel to the bedding of the quartzite, yet cuts it, in most places, at a small angle in both strike and dip. It has a strike northwest and southeast, and dips toward the northeast at angles varying from 70 deg. to vertical in the upper workings, while in places in the lower workings the dip is reversed to a steep angle toward the southwest.

The vein is unusually straight and varies in width from 5 to 25 ft. It follows a dike 18 to 36 in. wide, the ore occurring sometimes on one side, sometimes on the other, and often on both sides of it. The unaltered dike rock is dark greenish gray and fine grained, and has been termed an odinite by the members of the U. S. Geological Survey. The rock, however, for the most part is altered largely to chlorite and in places is merely a brownish mud. The fresh rock disintegrates rapidly when exposed on the dump. Portions of the dike are mineralized and in places narrow streaks or veinlets of ore run through it. An examination of the relations underground would lead to the belief that the ore deposition was later than the dike but F. L. Ransome[1] after petrographic study, has decided that the dike is younger than the ore.

The ore shoot was first encountered 800 ft. southeast of the shaft. It has an apparently vertical pitch, and extends for over 1200 ft. in length. The ore, consisting chiefly of galena with a very little blende and pyrite, occurs in streaks and bunches between the walls of the vein. Occasionally the walls are impregnated, but for only a short distance. Many stringers of ore branch from the lode into the footwall, but never extend for more than a few feet. The vein matter consists almost entirely of the country rock, quartzite, which between the walls is much cut up with slips, mostly vertical, but also with transverse, horizontal and diagonal slips. Most of these slips show slickensiding and a development of talcose material which makes the stability of the roofs of the stopes very uncertain.

Mine Plant and Equipment

The Hecla mine has one vertical three-compartment shaft, 19 ft. by 7 ft. 2 in. inside the lagging, and 1200 ft. deep. There are two main hoisting compartments, each 4 ft. 4 in. by 5 ft. 2 in., and a third compartment 7 ft. by 5 ft. 2 in., which is used as a pipe and ladder way, and also for handling the bucket used in sinking the shaft. The shaft timbers are all 12x12 in. in section, except the girt between the hoisting compartments, which is 8x12 in. The posts of the sets are 4 ft. 4 in. long, with an additional tenon of 1 in. on each end. The guides are of 4x6-in. timbers.

Three-ton skips are used for handling the ore, and to the bottom of each skip is attached a double-deck cage for the raising and lowering of men and supplies. The Ilgner system of hoisting is used, a system which has not yet come into common use in this country, but which is extensively employed in Germany. The German installations (and one American) have been described in several articles published in the Journal.[3] Briefly stated, the system consists of a direct-connected motor-driven hoist, the direct current for the hoisting motor being furnished by a motor-generator set which has a heavy flywheel on the armature shaft common to both motor and generator, or steering dynamo, as the latter is called. The speed of the hoisting motor is controlled by varying the current intensity in the field of the steering dynamo, a slight variation in the field producing a relatively large change in the current given out by the armature. The field of the hoist motor is separately excited by an exciter dynamo connected with the generator set.

The advantages of the system are many, but the following are important: In the first place, polyphase current may be used to operate the motor-generator set, thus obtaining all of the advantages which that current possesses in economy of transmission and ease of transformation; and yet the advantages of the direct-current motor for hoisting at varying speeds are retained. When polyphase-current motors are started under load there is a heavy current shock, resulting in the formation of a high peak on the recording wattmeter diagram, and a large expense to the consumer who buys power according to the "on-peak" load. To control the speed of this type of motor it is necessary to pass the entire current through a resistance, thus causing the waste of a large amount of power. With the Ilgner method of control a wide range of speed is possible with the loss of almost no electrical energy, and there is no sudden rush of current upon the hoisting motor for the current automatically builds itself up to the requirements of the load. Sudden variations in the load are compensated for by the energy stored by the flywheel of the generator set, and indeed the flywheel enables hoisting to be continued in case of short interruptions to the current from the central power station.

Details of Hoist and Generator Set

The hoist at the Hecla mine was furnished by the Wellman-Seaver-Morgan Company of Cleveland, Ohio, and has two reels, 5 ft. in diameter when empty, 13 ft. in diameter when full, each with a capacity of 2800 ft. of 4½x⅜-in. flat rope. The 10-in. drum shaft supports a 375-h.p. Westinghouse direct-current motor which has a speed of 60 r.p.m. and takes a current of 620 amp. at 500 volts. The speed of winding, when hoisting from the 1200-ft. level, accelerates during a period of 10 sec. from a zero initial speed to 1900 ft. per min. at the end of the trip. When the reel is full the maximum hoisting speed will be 2300 ft. per minute.

The power for the hoist is furnished by a motor-generator set consisting of a Westinghouse constant-speed induction motor, having a speed of 720 r.p.m. and taking a current of 109 amp. at 2100 volts, placed on the same shaft with a 450-kw. Westinghouse direct-current generator delivering a current of 860 amp. at 525 volts running at 720/580 r.p.m.;

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[1]*Professional Paper*, No. 62. U. S. Geol. Surv., 1908.

[2]Eng. and Min. Journ., Vol. 88, p. 110.

[3]Eng. and Min. Journ., Vol. 82, p. 537; Vol. 82, p. 585; Vol. 83, p. 238; Vol. 83, p. 718; Vol. 83, p. 897.

and a 25-kw. Westinghouse direct-current exciter-generator which supplies current at 125 volts for the field of the hoist motor. On the shaft between the motor and generator is a 29,000-lb. flywheel which stores sufficient energy to enable the hoist to be operated for several minutes after the power has been cut off.

An objection to electrically operated hoists for mining work is the liability of accident to the source of power, depriving the motor of current, often at critical periods. It would seem that the Ilgner system solved this problem in a most satisfactory way. The action of the hoist is smooth, being entirely free from any jerky motion, and on account of the absence of gearing is noiseless.

For handling the bucket and pipes in the third compartment the company has built over an old duplex geared hoist, by removing the old drum and gearing, and connecting the crank rods directly to a drum, 30 in. in diameter and having a 36-in. face. Compressed air is used to operate the machine.

Headframe and Ore House

The headframe is substantially built, 16x20-in. timbers being employed, and is 100 ft. high from the collar of the shaft to the center of the sheave wheel. The skips are dumped near the top of the headframe, each on a heavy plate made of interlocked steel rails, from which the ore slides to a grizzly about 12 ft. in length. The first 6 ft. of the grizzly is made of 2-in. round iron bars, spaced about 6 in., center to center, while the second section is composed of 1½-in. round bars. The oversize material from the grizzly drops on a steel plate, in reality a trap door, on which it is sorted. The screening is not complete and that which is sufficiently small is thrown back through the bars of the grizzly. Of the remainder three products are made: (1) coarse silicious ore which later is broken by hand and thrown down through the trap-door opening; (2) coarse smelting ore, and (3) coarse milling ore. Each grade of ore is thrown into its own bin, there being a set of bins for each side of the shaft. One man sorts the coarse ore from each skip, and is kept busy when the hoisting is at the normal rate.

The undersize of the grizzly drops into two bins which have hopper bottoms provided with end-shaking discharge chutes, the operating mechanism of the chutes being thrown in and out by means of friction clutches. The chutes, or feeders, deliver the ore on a 30-in. rubber sorting belt which travels about 30 ft. per min. A stream of water washes the ore on the belt. Two men attend to the feeding chutes and do all of the sorting, picking out the waste and the high-grade or smelting ore. The milling ore is left on the belt and is discharged on a grizzly about 3 ft. in length, made of ten ¾-in. iron rods with 1¼-in. spaces, feeding to a 9x15-in. Blake crusher. The wash water is collected at this point and goes to a settling tank. The undersize of the grizzly and the product of the crusher both drop into a bin from which the ore is fed through a gate to a 16-in. rubber belt and conveyed up an incline of 6 deg. to the railroad bins about 225 ft. distant. This belt discharges into a long hopper which may be moved backward or forward on a track, and delivers the ore to any one of four chutes or troughs, each of which serves a bin.

Sorting plants are not in general use in the Cœur d'Alene district but the advantages of their use are seen at a glance by anyone visiting the various concentrating mills. Crushing to at least 30-mesh is necessary in order to liberate all of the metallic particles, and though graded crushing is employed, the ore produces a considerable amount of slimes which on account of the talcose nature of this fine material is difficult to concentrate. In mills which do not employ sorting before concentration, it is no uncommon thing to see on the Wilfley tables fans of galena concentrates up to 18 in. in width. The loss in milling ore of such high-grade material is obvious.

Surface Plant at Hecla Mine and Portion of Town of Burke, Idaho

Compressor Plant

Air for the mine and surface plant is furnished by an Ingersoll-Rand, Imperial, Type 10, two-stage air compressor having a capacity of about 1800 cu.ft. of free air per min. when operated at a speed of 115 r.p.m. This compressor is belt driven by a 300-h.p. General Electric, Type I, Form M, alternating-current motor, taking current at 2050 volts and running at 514 r.p.m. There is also an old steam-driven Fraser and Chalmers duplex, single-stage air, Corliss compound steam, air compressor with a capacity of about 2500 cu.ft. of free air per min., which is used only in case of emergency. Steam for the compressor is furnished by two 250-h.p. Stirling boilers.

The mine has a well equipped machine shop and blacksmith shop, the latter containing also an Ajax drill sharpener. The carpenter shop contains a circular saw for cutting the stull timbers, what little framing is required being done by hand.

Methods of Mining

The mine has three working levels, viz., at the 300-, 600-, and 900-ft. levels, and a fourth level is being started at a depth of 1200 ft. The drifts from the shaft to the orebody, about 800 ft., are driven 5x7 ft. in the clear, while in the ore the drift is cut out for the full width of the vein before stoping is commenced. The development work, shaft sinking and drifting from stations to ore, is done on contract. With a 2¼-in. machine, working two 8-hour shifts every day in the week, the monthly advance averages 100 ft., while with a 3¼-in. machine the average is about 120 feet.

In stoping the vein matter is taken out from wall to wall, no pillars being left. The ore is mined by overhand stoping in successive horizontal slices, work being carried on simultaneously throughout the length of the orebody, 1200 to 1500 ft. The stopes are all timbered with stulls 12 to 20 in. in diameter, the average being about 16 in.. As the maximum length that can be conveniently handled underground is 16 ft., two stulls with their butts together are used in the wider stopes. No hitches are cut in the walls, the ends of the stulls bearing against headers, or blocking, which, when all is in place, are tightly wedged. These headers are removed as required to relieve the pressure from the walls. The ends of the stulls, as is also the butt joint where two are used, are supported on posts resting

on the stulls of the floor below. In some instances the middle of a long stull is supported by an intermediate post, but this is not universal. Occasional pieces of 2-in. or 3-in. plank serve as collar braces, but many of the stulls have no bracing. The floors of the stulls are 9 ft. apart vertically, and the stulls are placed 5 ft. apart, center to center, in the rows. Three-inch planks cut 5 ft. long are used for flooring and for lagging.

Both the walls and vein filling give a great deal of pressure, and most of the stopes have to be filled. For this purpose waste is sorted from the ore underground and that from the sorting plant on the surface is lowered on the cages and trammed into the stopes. All of the waste from development work is used for filling; before the sorting plant was operated blind raises were driven into the walls of the stopes and the country rock broken for filling.

At 50-ft. intervals along the drifts three-compartment raises, consisting of an ore chute, a compartment for hoisting timbers and tools, and a ladderway between them, are carried up with the stopes. Except in the case of a cribbed raise each compartment occupies the space between two stulls. In the ladderway platforms are placed at every second floor, and the ladders are inclined, making climbing easy and safe.

Hoists Used in All Stopes

The chutes are carried up vertically through the stopes, and there are no offsets except where the dip of the vein makes it necessary or advisable to jog the chutes toward the footwall. This means a long drop for the ore and the resulting wear of the timbers is severe. The chutes are kept within one or two floors of the roof of the stope. The broken vein matter is dropped to this floor where it is rough sorted and the ore wheeled to the chutes in wheelbarrows, or shoveled if near enough. Three raises, one at each end and one in the middle, are put up through the orebody in advance of stoping. A small winze hoist operated by air is placed near each raise for hoisting steel and timbers to the stopes. No other raises are put up in advance, windlasses being used in other cases to hoist timbers, etc., to the stopes.

In most cases, 2-in. lagging is carried clear across the worked-out portion of the vein on each side of the raises, and the intervening 50 ft. of open stope filled with waste. An open space is thus maintained 15 ft. long and the width of the vein, in which the chutes are built. The latter are marked off by girts between the stulls. The ordinary ore chute is lagged with planks placed vertically, the planks being cut in 9-ft. lengths so that the joints come at the centers of the stulls. The manway and timber compartment are lightly lagged, the side next the open stope being frequently left without lagging. In spite of the fact that the portions of the stulls opposite the chutes have no bracing except an occasional piece of plank, they show no effect of pressure or crowding from the filling behind them.

A few cribbed chutes are used. These are made of 10x10-in. squared timbers and are lined with 3-in. planks. The wall plates of the cribbing are 12 ft., and the end plates 6 ft. 4 in. long. The space thus inclosed is divided to form the ore chute, the timber compartment, and a narrow ladderway. Waste is packed all around the cribbing. The opening for both styles of chute are 30 in. wide, and are provided with plank gates made in three sections.

The ore is trammed to the shaft in end-dumping cars of 1½ tons capacity, drawn by mules in trains of seven cars each. A mule is worked but four hours each day and consequently the animals are kept in excellent condition. All drifts and underground stations are lighted by electricity.

Comments on the Mining Practice

During the last few years the tendency in mining practice has been to increase the distance between the working levels. The Hecla mine probably represents the extreme in this tendency, yet the method employed has given excellent satisfaction. The chief point of objection is the fact that the length of the time required to extract all of the ore from a block of ground 300 ft. in hight and 1200 to 1500 ft. in length allows ample opportunity for the complete deterioration of the lower sets of timbers, and a cave on one of the levels would shut off, temporarily, a large part of the normal output of the mine. As a matter of fact the drift sets have to be renewed before the stopes are half worked out, but the hight of the sets allows ample space for reinforcing, and facilitates the placing of new sets whenever required.

It is likely that a saving in the cost of handling the ore would result if the chutes were placed farther apart and light mine cars were used in the stopes. The present chutes are just too far apart to shovel into to the best advantage, making necessary the use of wheelbarrows. The cost of these chutes is considerable, the ordinary chute requiring about 50,000 ft. of sawed lumber, while about 130,000 ft. are required for the cribbed chute. At $18 per 1000 ft. the cost for sawed lumber alone would be $900 and $2340 respectively, or a total of $32,400 for the 23 lagged and five cribbed chutes which are in the block between the 900- and 600-ft. levels. The cost in place would be approximately $40,000. By the use of cars in the stope the number of chutes could be reduced to eight, the cost for each of which should not greatly exceed the average cost of those now in use. Assuming a tonnage of 250,000 in the block of ground mentioned, there should be a saving through the decrease in the number of chutes, of over 11c. per ton to apply to the increased cost of tramming in the stopes. The trammers in this mine receive $3.50 for eight hours' work, so the saving would not be large.

The use of stulls, rather than square sets, in stopes as wide as those in the Hecla mine is not common, yet it has here proved most satisfactory. There is a saving in the first cost of the timber, and almost no framing is required. The Hecla management is able and progressive and the property is maintained in far better condition than are some which have larger and more expensive staffs.

Goodrich Gulch, Washington

Wolframite was discovered in Goodrich Gulch, Wash., Nov. 1, 1909. The discovery is eight miles from Twin Bridges, Mont., the nearest railroad station, and is reached by wagon road from that point. Advices from the spot state that the wolframite carries 60.2 per cent. tungstic acid; as the pure mineral contains about 75 per cent., it is probable that this assay represents a specimen rather than the ore itself.

The ore occurs in two narrow veins, 12 and 18 in. wide, in a mica schist and gneiss. The veins are exposed in three places over a length of 1150 ft., and the owners contemplate making surface cuts and running a drift tunnel as soon as the snow leaves the ground in the spring.

There are other veins in the district, some of large size, and the gold, silver and lead contents of these are encouraging prospectors to further work. Among these are the Grand View, Two Sisters and Red Bell groups, owned by Schmidt, Miller, Clodius and Schmidt, who are opening them by tunnels.

Dullea & Trauffler are working to the north of the Red Bell. This group has shipped some ore from the surface workings. The Little Goldie group, owned by Anderson & McKinzie, produces free-milling gold ore, and the Carolina group is now shipping. The American Goldfield Placer Mining Company proposes to spend $15,000 in the spring building a dam to store water for hydraulic purposes.

In Bear gulch, next to Goodrich gulch, the Stuart brothers are working a galena claim. Moffett and partners own a group of claims, carrying copper and gold, and developed to a depth of 265 ft. The adjoining group has opened the same vein, but both are idle, it is said on account of disagreement between the owners of these properties.

Experiments in Reverberatory Practice, Cananea

Oil a Better Fuel Than the Local Coal; Pure Quartzite for Furnace Bottoms; Use of Reverberatories with Blast Furnaces Recommended

BY L. D. RICKETTS*

In 1895 or 1896 the Cananea Consolidated Copper Company decided to install a reverberatory furnace in connection with McDougal calciners. Accordingly a calcining building, containing four six-hearth McDougal roasters 18 ft. in diameter and a reverberatory furnace 19 ft. wide by 100 ft. in length, on the general plan and style of the Anaconda furnaces, were erected.

On account of the special features of the only possible site, the boilers had to be set at some distance from the reverberatory and were connected with it by a flue supported for a portion of the distance on a steel bridge, and having a cross-section of but 25 sq.ft. A departure was made from the Anaconda practice, three boilers of 300 h.p. each being set up in parallel, the idea being that two of these boilers could be run and one stand as a spare.

The original reverberatory was built with the furnace having a grate area 17x 7 ft., and having the bridge wall 2 ft. 2 in. above the grating. The area over the bridge wall was 110 sq.ft., and the throat of the reverberatory was 21 sq.ft. less than the cross-section of the flue. The general dimensions of the furnace may be seen from Fig. 1, except that the firebox has now been removed. The throat has been increased to 32 sq.ft. and the flue to 27 sq.ft., the greatest cross-section obtainable under existing conditions.

Pure Quartzite Best for Furnace Bottoms

At the time of the installation of this reverberatory good material for a bottom was not to be had in the vicinity, and while silica brick was imported from Pennsylvania, an attempt was also made to build the bottom out of local material. The first bottom put in was made of sands separated from the tailings from the concentrator, and having the following partial composition: SiO_2, 66.4 per cent.; Al_2O_3, 13.1; Cu, 0.8; Fe, 2.6; S, 1.9.

This material immediately gave trouble. It was slagged and floated up and had to be torn out. A quartzite that was used for converter lining, containing about 90 per cent. silica, and 2 to 3 per cent. alumina was then tried. This material also failed, and a very pure quartzite, running about 95 per cent. silica, from Colorado, was tried and proved a success, and the bottom has never since been changed.

The records of metallurgical operations previous to 1907 are very incomplete, and while experiments were made in smelting flue dust, the records regarding the tonnages and tests are not sufficiently complete to warrant quoting them; but it may be taken for granted that the tonnage treated previous to Jan. 1, 1907, was small.

The reverberatory resumed operations on Feb. 1, 1907, and ran for nine months, the total operating time being 247¾ days, and during this time the furnace averaged 122 dry tons of charge per day.

Southwest Coal not Satisfactory Fuel

Two classes of coal, costing during this period from $9 to $10 per ton, were available. One of them was coal from Dawson, N. M., representing the general composition of the coking coals of that district, and the other a lignite from Gallup, N. M. I quote the analyses in each case, representing composite samples of a number of carloads.

COALS USED IN 1907.

	Dawson. Per Cent.	Gallup. Per Cent.
Water	1.7	10.7
Volatile matter	32.6	34.6
Fixed carbon	52.4	48.4
Ash	13.3	6.3
	100.0	100.0
B.t.u.	12,135	10,247

The Dawson coal is a high-ash coal with strong coking qualities, and when using this fuel alone the volatile matter burned off rapidly and left a heavy bed of coke on the grates, which burned very slowly. The Gallup coal, on the other hand, is too light and does not produce a sufficiently intense heat, and it was found that a mixture of the two coals, about half and half, produced the best results obtainable, which were, however, bad at their best, as the tonnage treated by the furnace shows.

After trying these fuels from February to August with unsatisfactory results, we installed pulverizers, removed the firebox, and burned pulverized coal in the furnace. The figures, however, do not show that the experiment was successful. While we could undoubtedly produce a much longer flame and a much higher degree of heat, yet a number of difficulties were encountered.

One arose in regulating the amount of air, as sometimes too much was admitted, and at other times so little that incomplete combustion resulted, even to the extent of depositing a layer of fine carbon on top of the charge which appeared to form a nonconductor and retarded the smelting operations. Another difficulty, and by far the most serious one, was due to the fineness of the ashes which would fill up the flues and render the recovery of waste heat from the furnace gases impossible.

During this period the highest monthly cost per ton of dry charge treated was $8.49, and the lowest cost was $4.75. The highest cost per ton for coal alone was $6.16, and the lowest was $3.32. The highest percentage of coal used was 61 and the lowest was 33.6 per cent. It should be noted that the least coal consumption occurred during the two months in which we used the pulverized coal, and during which there was no steam generated from the waste gases. The average net cost, giving fuel credit to the reverberatory for the period in question, was $5.49 per ton, made up of the following costs: Labor, $0.795; supplies, $0.293; coal, $4.067; power, $0.177; miscellaneous, $0.13; repairs, $0.358; flux, $0.01; total, $5.83; from which is deducted a steam credit of $0.34; leaving a net cost of $5.49 per ton smelted.

The works closed down in the latter part of October, 1907, and experiments were stopped for the time being, but it was thought we had proceeded far enough to demonstrate that the coal obtainable from the Southwest was not well adapted to reverberatory practice.

Results with Fuel Oil from Oklahoma

Hitherto there had been a prohibitive duty on fuel oil imported into the Mexican republic, but during the early part of 1908 the Mexican government modified the law in this respect and permitted the importation of fuel oil into Mexico under restrictions, to be used strictly for fuel purposes, and permission was given the Cananea Consolidated Copper Company to import this fuel oil.

As a consequence, all idea of using coal as a fuel in the reverberatory was abandoned, and when the work was resumed at the reduction works at Cananea, preparations were made for burning fuel oil and a contract was made for our requirements for fuel oil from the Oklahoma fields. On account of the fact that this oil as produced from the wells, although having an asphaltic base, contains a large amount of gas and some small amount of light paraffins, it is subjected to a preliminary distillation and the residue shipped as fuel oil. This distillation is very light, and the resulting residuum has a specific gravity of about 0.9, and contains from 19,400 to 19,700 B.t.u. per

NOTE—A paper read before the Institute of Mining and Metallurgy, London, Nov. 18, 1909.

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lb. avoirdupois, and weighs about 310 lb. per bbl. of 42 gal. at a temperature of 60 deg. Fahrenheit.

We resumed operations at the reverberatory in the latter part of July, 1908, using this oil fuel, and for the time being turned the gases out of doors. We used Hammel locomotive oil burners for feeding the oil, and ran for about five months of 1908, and on Sept. 1 we turned the gases through the three 300-b.h.p. Stirling boilers. In the first five months we ran 150 days and treated the following material:

Flue dust, 19,737 tons; calcines, 9554; silicious ores, 1192; iron and limestone, 574; barren silica, 274; total, 31,331 tons.

COSTS FOR FIVE MONTHS IN 1908.

Labor, operating and repairs	$14,829.39
Shop expense	1,966.64
Supplies (firebrick, etc.)	5,613.13
Fuel oil	56,217.15
Power	445.83
Miscellaneous expense	533.78
Total	$79,605.92
Cost of barren fluxes	609.90
Total	$80,215.82
Less steam credit	24,267.37
Net account smelting	$55,948.45
Average cost per dry ton smelted	$1.785

29,802 tons; calcines, 5484; silicious ores, 2300; fluxes, 3129; total, 40,715 tons. We produced 10,120 tons of matte and foul slag, 25,658 tons of slag, and volatilized 4937 tons.

evaporated 13.96 lb. Taking account of the temperature of feed water and converting into evaporation from and at 212 deg. F., we have the following figures: Evaporation per pound of oil burned in reverberatory, 7.45; evaporation per pound of oil burned under power-house boilers, 16.08 pounds.

The average slag analysis during the period was as follows: Cu, 0.45 per cent.; SiO_2, 40.10; Al_2O_3, 11.20; FeO, 34.80; CaO, 8.50; S, 0.70; ZnO, 2.30; MnO, 0.30; MgO, 0.40; total, 98.75 per cent.

The total cost of smelting per dry ton in this period is given in an accompanying table.

This cost in no way refers to calcining

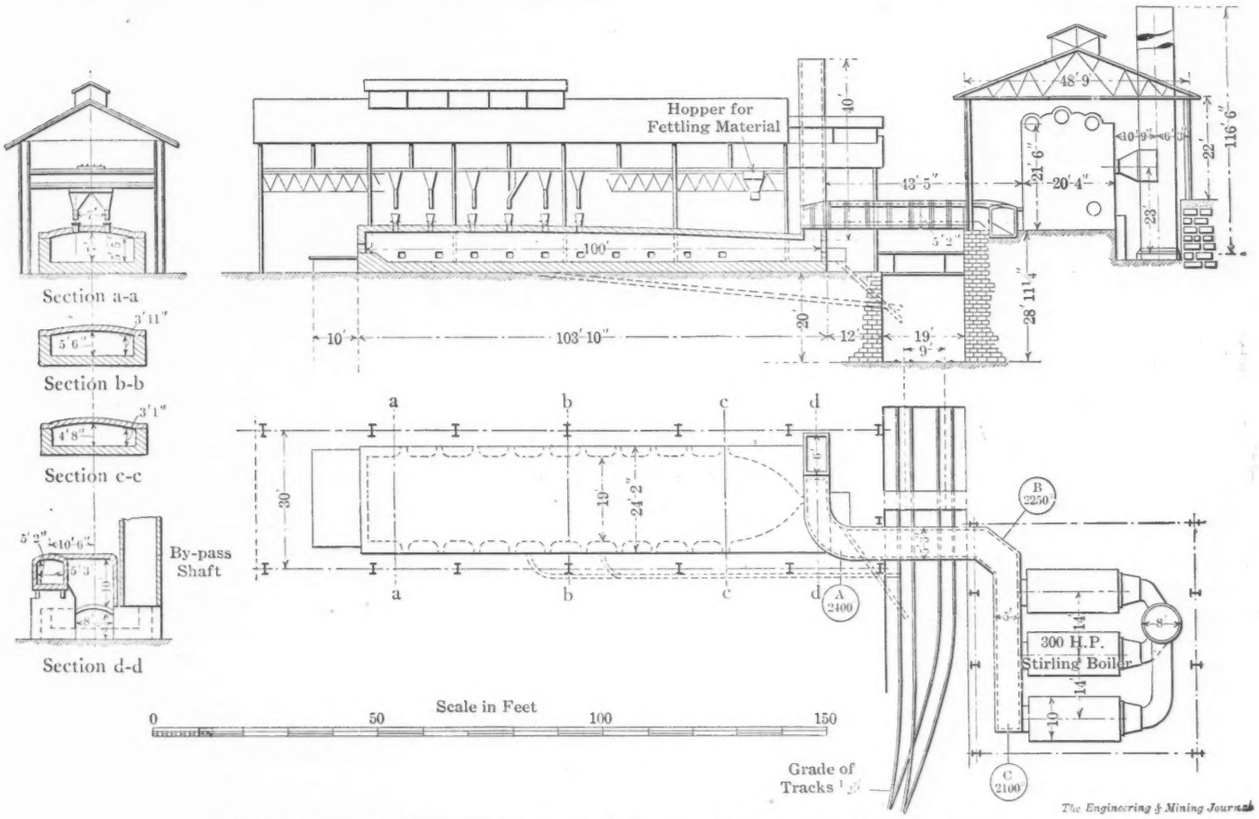

FIG. 1. ORIGINAL REVERBERATORY OF CANANEA CONSOLIDATED COPPER COMPANY

The total charge averaged 209 tons per day. We produced 7039 tons of matte and 20,351 tons of slag, and 3941 tons were volatilized. The charge contained 8.43 per cent. copper and 8.99 per cent. sulphur—1.065 units of sulphur to the unit of copper.

The matte averaged 36 per cent. copper, and the copper recovery in the matte averaged 95.76 per cent. of the total copper contents. The slag had the following partial composition: Cu, 0.55 per cent.; SiO_2, 39.20; Al_2O_3, 10.10; FeO, 40; CaO, 4.30. The costs for the five months are given in an accompanying table.

OPERATIONS IN 1909

For the first six months of 1909 the reverberatory furnace ran 165.7 days, and treated the following tonnage: Flue dust,

The percentage of copper in the charge was 7.08, and of sulphur, 9.77; the ratio of sulphur to copper was 1.38 per cent.; the percentage of copper in clean matte, 30.57; and the percentage of recovery of copper in the matte, 96.04; dry tons smelted were 245 per day.

OIL CONSUMPTION

Barrels of oil consumed	39,417
Barrels of oil credited to steam	17,471
Net gallons of water evaporated	9,883,493
Barrels of oil charged to smelting	21,946
Gross barrels of oil consumed per dry ton of charge	0.968
Barrels of oil per dry ton smelted credited to steam generation	0.430
Net barrels of oil per dry ton charged to smelting	0.538
Average net b.h.p	664.3

The actual water evaporated per pound of oil burned in the reverberatory was 6.74 lb., whereas the pound of oil burned under the smeltery power-house boiler

the concentrates that were smelted, and the weight is the weight of the calcines and not the weight of the dry concentrates.

COSTS PER TON SMELTED, FIRST SIX MONTHS OF 1909.

Labor, operation	$0.24
Labor, repairs	0.16
Supplies	0.22
Fuel oil	1.73
Power	0.02
Miscellaneous	0.08
Total direct costs	$2.45
Cost of fluxes	0.08
	$2.53
Steam credit	0.77
Net cost	$1.76

The concentrates roasted in the McDougal calciners were of the finest grade that we produce. The concentrates and calcines had the partial composition shown in an accompanying table.

The shrinkage in calcining averaged about 15 per cent. from dry concentrates to calcines.

PARTIAL ANALYSIS OF CONCENTRATES AND CALCINES.

	Concentrates. Per Cent.	Calcines. Per Cent.
Copper	7.94	9.36
SiO_2	25.90	30.50
Al_2O_3	4.60	5.40
FeO	24.90	29.30
S	27.90	9.00
	91.24	83.56

Best Tonnage and Cost Records

The record month as regards both tonnage and costs was January, 1909. In this month we smelted: Flue dust, 4639 tons; calcines, 2711; silicious ores, 359; fluxes, 440; total, 8149 tons; an average of 263 tons per day. We used 7003 bbl. of oil, of which 3102 bbl. were recovered as an equivalent in steam, and 3901 were charged to smelting.

The charge contained 7.13 per cent. copper and 7.51 per cent. sulphur; the matte contained 40 per cent. copper, and the recovery of copper in the matte for the month was 95.97 per cent. The slag had the following partial composition: CuO, 0.41 per cent.; SiO_2 41.20; Al_2O_3, 11; FeO, 34.60; CaO, 7.30.

The net cost per dry ton smelted, including cost of fluxes, was $1.29 per ton, after $0.67 per ton had been deducted from the gross cost on account of steam credit.

Fuel and Water Carefully Measured

With regard to determining the fuel consumed and the amount of water evaporated, it may be stated that the fuel oil is brought in standard-gage tank cars to three receiving tanks of 10,000 bbl. capacity each, and discharged into them by gravity. From these storage tanks it is conveyed through pipe lines either by gravity or by the aid of pumps to the various points where it is consumed.

At each point of consumption there is sometimes a subsidiary storage tank and always two small tanks with accurate gages upon them. Oil is consumed from but one of the latter tanks at a time, and at the end of each shift the alternate tank, which in the meantime has been refilled, is thrown in and the other tank cut out. A record is kept by measure of the amount of oil consumed by each shift.

At the end of each month a careful survey is made of the storage tanks and the subsidiary tanks, in connection with oil received during the month, and any discrepancy due to shortage of oil in the cars, or any deficit whatever between the oil actually paid for and the record of the oil consumed (and there is always a small discrepancy) is charged up against each point of consumption in proportion to its record of the barrels of oil consumed.

The feed water for the reverberatory boilers is fed into a storage tank by means of a weighing meter, a simple tilting device connected with a revolution counter, designed by David Cole, assistant general manager. It has various appliances for minimizing friction, and is provided with a double-headed piston working in a cylinder closed at both ends, but with a slot in the middle which prevents the measure from falling with great force when it once starts to tilt.

This device has been found to be quite satisfactory and is checked frequently by temporarily stopping the feed pump to the boilers and letting the meter run until it fills the tank into which it discharges. The water going into the main power-house boiler is likewise measured.

Both at the boiler house and at the reverberatory, the boilers are blown off at regular intervals and a deduction is made from the total amount of water fed, in accordance with a close estimate of the amount of water blown off. This factor is decided on by instructing the attendant to blow off his boiler for a definite length of time with an agreed amount of opening through his blowoff valve, and the quantity of water blown off has been estimated by reading the gage glasses. I think, therefore, that these figures of evaporation are trustworthy.

Operation of Boilers

The reverberatory furnace is required to pay for operating and maintaining its own boilers. All three boilers are used in parallel, except when being cleaned. A damper is provided for each boiler and once a month each boiler is cut off and cleaned, so that for about five days in each month there are but two boilers in operation, and the balance of the month three boilers, it taking nearly two days to clean a boiler thoroughly. When repairs to the reverberatory are necessary all of the boilers are cleaned, even if they have run less than a fortnight without cleaning.

We have tried three classes of burners: first, the Hammel locomotive oil burner; second, the Shelby burner, designed by Charles F. Shelby, superintendent of our reduction works, and third, the Kittle burner. We have found that the Shelby burner is better adapted to the work than either of the other two, for the reason that it throws the flame farther toward the front of the furnace, thus avoiding the intense heat produced by the other two classes of burners at the back of the furnace. We use four burners.

We set up a portable boiler at the reverberatory and have made a number of tests to determine the amount of steam used in operating the burners. We find on an average that 0.44 lb. of steam is required to inject a pound of oil through the burners, and this amount is deducted from the net steam evaporated by the waste gases. In other words, the reverberatory pays for the steam it uses in injecting the oil into the furnace. Thus, for the first six months of 1909 the evaporation was 6.74 lb. actual, but 0.44 lb. was deducted for steam used in the burners, making the credit 6.30 pounds.

Calcining in McDougal Furnaces

Our costs for calcining in McDougal furnaces are of little value on account of the intermittent character of the work and the small tonnage calcined. In January we treated 3186 tons of concentrates, dry weight, and produced 2711 tons of calcines. The cost was $0.54 per ton of dry concentrates, and the shrinkage in weight amounted to 14.9 per cent. In June the cost was $0.38. In other months we have calcined so little, even less than 200 tons, that the costs have been excessive and have been as high as $1.14 per ton of concentrates. For the 11 months from July, 1908, to June, 1909, we calcined 17,533 dry tons of concentrates at a cost of $0.5176 per ton, and produced 15,038 tons of calcines. There were 177 tons of fine lime rock mixed with the concentrates during the period.

The reason for the low tonnage treated in the McDougal calciners is that at Cananea 45 per cent. of the blast-furnace charge is concentrates, and while we use a low blast pressure, about 20 oz. as a rule, we produce on an average, from 4500 to 5000 tons of flue dust per month, and all of this material has to be smelted in the reverberatory. This is the reason why we have not obtained lower costs in calcining.

The concentrates are, however, well adapted for calcining in McDougal furnaces, and were we to run these furnaces at their full capacity the total expense would probably not exceed $0.40 per dry ton. This is only an estimate, because we have never spent the money to provide proper bins from which the concentrates can be drawn into charging cars, and we have never run the furnaces up to their full capacity; frequently all four of the furnaces have been closed down. As yet we have experienced little wear and tear, except on the blades of the rakes on the top tier, at times when very wet concentrates are being treated.

Effect of Calcines on Smelting Cost

In inspecting the monthly costs and the tonnages smelted per day in the reverberatory, it is evident that the calcines are more cheaply smelted than flue dust, and during the month of January, when our reverberatory costs were but $1.29 per ton, we smelted the highest percentage of calcines that we have ever treated for any one month, and we also had the least consumption of fuel oil per ton smelted. In my opinion the reason for this is twofold: In the first place, the calcines as they enter the furnace are hotter than the flue dust by probably 400 to 500 deg. F., but this is not the main

reason why the tonnages are greater with calcines. Flue dust is blown from the top of the charge in the blast furnace and the particles have not had time to come into contact with and adhere to other particles, but are blown by the blast from the top of the charge and largely oxidized with extreme rapidity while traveling through the air.

On the other hand, in the McDougal furnace the particles of concentrates are gradually ignited, and are thoroughly stirred in contact with each other for a long period of time; the temperature reaches a red heat, and were it not for the rakes the charge would undoubtedly sinter. In other words, in the McDougal furnaces the particles are heated to incipient fusion, and besides the oxidation of the iron and the sulphur, a notable chemical union takes place between the acid and base. I think this chemical action that has occurred in the McDougal calciners between acid and base, permits much more rapid fusion in the reverberatory furnace.

Claying the Furnace

The method of claying the furnace to protect the side walls from corrosion at the matte line is illustrated in Fig. 2. This method originated in Cananea, I think, and was suggested by Mr. Gmahling and installed with the approval of Mr. Shelby. The side walls of the furnace are built with a slight batter, as is shown in the sketch. A 5x5-in. aperture is left in the arch close to the side walls on either side, and these apertures are 18 in. between centers for the entire length of the furnace.

A hopper on either side of the furnace travels on a rail so that the charge of fine silicious ores previously wetted down may be brought over any one of the holes in question. Every day this material is simply dropped through these holes in proportions that are deemed necessary from the appearance of the furnace, and it trickles down along the side walls and builds up in a bank against the slag line. It is then gently tamped down with an iron tamping bar. If we are not actually charging this material, the holes are kept closed with firebrick and covered with fine ore to prevent infiltration of air into the furnace.

By this method we do not have to run down the furnace to clay it, and every day 10 to 15 tons of silicious ore are thus smelted, and while this material requires flux, as our records will show, it not only protects the sides of the furnace but smelts this very refractory material more cheaply than we could smelt it in the blast furnaces.

Temperature of Gases

A number of experiments were conducted at my request by John Langton, consulting engineer, with regard to the temperature of the escaping gases, and a series of tests shows that the temperature of escaping gases between the reverberatory and the boilers averages as follows:

At *A* (see Fig. 1), 2400 deg. F.; at *B*, 2250; at *C*, 2100. Repeated tests show that the temperature of the gases after passing the boilers and escaping in the common boiler stack is 750 deg. Fahrenheit.

Mr. Langdon estimated that further cooling of the gases by the use of economizers would increase the percentage of recovery of steam from the waste gases about 20 per cent., with the understanding that the amount of heat to be recovered is so considerable that the feed water for the main power-house boilers would be heated in these economizers as well as that for the reverberatory boilers themselves. He calls especial attention to the fact that the flue leading from the furnace to the boilers is far too small in cross-section, and that properly this flue should have at least 50 sq.ft. in cross-section, instead of 27 square feet.

Analysis of Costs

An examination of the statistics given above shows plainly that the costs for labor, supplies and repairs have been high. This has not only given too high a cost per ton, but has necessitated stoppages of from one to ten days for repairs to the arch. During the shorter stoppages we have simply filled up the furnace with flue dust at the point where repairs to the arch were to be made, and tamped it down, using the flue dust for a center. After repairs are made, the flue dust is partially raked out and smelting operations proceed.

During the time of making minor repairs we open up one of the doors on either side in front of the point to be repaired and keep two oil burners burning through these doors to prevent the slag from chilling to an excessive degree; but in spite of this it follows that after smelting is resumed the capacity of the furnace is very light for several days, and it takes four or five days to get back again to its normal capacity. This, of course, tends to increase the cost of smelting.

Another cause for the high costs for repairs was that at the time of using pulverized coal as fuel, we had to tear out the flue leading to the boilers and build a side stack to allow the gases to escape directly into the air. Later on we rebuilt the flue to the boilers, using firebrick because we had no silica brick,

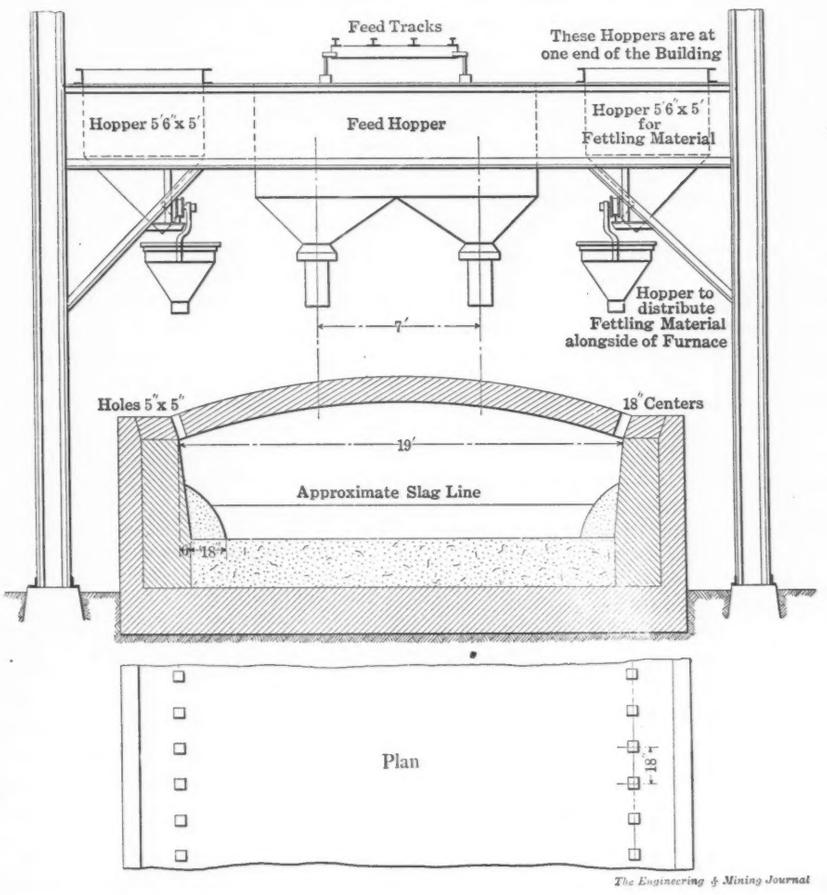

Fig. 2. Section of Furnace Showing Method of Charging

and in starting up with fuel oil we found that this burned out rapidly, and the entire flue had to be torn out and replaced by silica brick when we got it. All this was charged to operation.

But the main cost and most serious expenditure has been for repairs to the arch. The furnace was built with 12-in. brick in the arch, and in experimenting with oil burners we have burned out the roof three times, once to such an extent that we had to close down for days and entirely rebuild one-half of the arch at the back end of the furnace.

We are of the opinion that this was due to insufficient knowledge of how to use the burners, and to permitting the flame to impinge against the roof, thus destroying it. We have burned out the roof frequently, and that we can prevent the necessity for such frequent repairs in future is as yet a matter of opinion only; but we believe that we have now learned to fire without destroying the roof, and we feel that our opinion should carry weight.

I have ordered 20-in. silica bricks, and when they come we shall close down the furnace to rebuild the arch with these 20-in. bricks, and then we shall determine whether our opinion is correct or not. I may say, however, that I am convinced that in burning oil no bricks shorter than 18 to 20 in. should be used in the arch.

We feel that, considering the results of our tabulated experiments and of the experience that we have gained, we can materially decrease our present costs in three ways: (1) By decreasing the cost of material and labor for repairs; (2) by decreasing the excessive stack temperature at present existing; (3) by increasing the average daily capacity by fewer delays due to repairs, and by decreasing the amount of flue dust produced by the blast furnaces, and increasing the amount of calcines from the McDougal furnaces.

Summary

A summary of the preceding pages will show that we have smelted about 30,000 tons of material, using such coal as is available in the Southwest for fuel, and that we have smelted about 72,000 tons, using oil as a fuel. The cost of smelting with coal with the conditions under which we operated was very high, and with our decreased costs in blast-furnace practice it would now be prohibitive, but our figures show that our average cost of smelting with fuel oil, including every possible charge, has been about $1.77 per dry ton of charge. The material smelted has consisted for the most part of flue dust, but to some extent of calcines, and the latter have been derived from our finest grade of concentrates.

I have called attention to the fact that calcines are much more cheaply smelted than flue dust, and while we have to pay the cost of calcining, we have to smelt but 85 per cent. of the weight of concentrates. Allowing for a reasonable decrease in costs due to the nature and temperature of the calcines, it may be safely said that a ton of fine concentrates of the composition quoted may be calcined and smelted in a reverberatory furnace for about the same cost as a ton of flue dust. We have demonstrated that we can smelt flue dust and fine concentrates at a cost of $1.77 per ton, and, if my conclusions are correct, this cost may be reduced to $1.40 per ton and probably to even a less amount.

A very important question is what application should be made of this knowledge? My experience on an extensive scale in mining and beneficiating copper ores is limited to Arizona in the United States, and Sonora in Mexico. In this latter district, there are copper mines of various classes, either developed and producing, or in the process of development. These include mines that produce first-class smelting ores solely; mines that produce first-class ores together with ores that have to be concentrated; mines that produce concentrating ores solely, but with a notable amount of the concentrates in cubes of about 4 mm. diameter; and lastly, mines now in process of development from which the ores will be concentrating ores entirely, with no concentrates coarser than 1- or 2-mm. cubes.

Blast Furnaces and Reverberatories Compared

Although experiments have been tried with small reverberatories, the Cananea company is the only one using a reverberatory regularly, and smelting operations elsewhere in this district are virtually confined to blast-furnace practice. I think it is safe to say that the cost of smelting a dry ton of self-fluxing mixture deducting the flue dust produced, and the matte if any be added to the charge, is seldom less than $2.50 per ton, and I believe never less than $1.75 per ton in blast-furnace practice in the district referred to, and this cost applies to the average mixture, including all grades of ores and concentrates. It is undoubtedly true that the cost of smelting flue dust or fine concentrates in a blast furnace will average far higher than does the cost per ton of the average mixture, and if we assume a cost of $2 per ton of dry charge exclusive of flue dust produced and matte added, the actual cost of smelting fine concentrates and flue dust in the blast furnace more nearly approximates $4 per ton.

The sulphur ratio in a blast-furnace charge will vary owing to the composition of the sulphides and the ease with which the sulphur is oxidized in a given combination, but to a much greater extent it depends upon whether the minerals containing the sulphur are in a state of fine division or in coarse lumps. Thus there can be no question that pyrrhotite or iron sulphides in coarse lumps added to a charge requiring more sulphur will produce a lower grade of matte than the same sulphides in the same quantity would produce if crushed exceedingly fine. The all-important question of the sulphur ratio, therefore, depends upon the composition and coarseness of the charge and each case must be settled by experience and empiric knowledge.

In the case of Cananea the major smelting operations must be conducted in the blast furnace, and we must keep in mind the necessity of maintaining a sufficiently high percentage of sulphur in the charge with a view of smelting with a high degree of oxidation to the production of a medium grade of matte using a minimum amount of coke.

As long as our first-class ores maintain their present composition, and are produced in the same ratio to the concentrates made, I do not see how we can expand our reverberatory operations beyond present practice, but the figures given will, I think show the great advantage the reverberatory is to us under the present conditions. It not only permits us to smelt our flue dust and some fine concentrates for less than the ton costs in the blast furnace for the average mixture, but by removing fine material from the charge it lessens the blast-furnace ton costs in several obvious ways and decreases the flue-dust losses.

I do not hesitate to express my belief that great saving may be made by the introduction of reverberatory practice elsewhere, and I think that there are no works of large size in the Southwest that would not find it of advantage to use a reverberatory in conjunction with blast-furnace practice. I also believe that there are certain mines where reverberatory practice should be the more important process of matting, even if it should become necessary to mix fine or crushed pyritic ores with the concentrates before calcining, and in such cases the blast furnace will be used only in minor part for secondary products, and such small amounts of coarser raw materials as may be available.

The new institute being erected in Vienna by private endowment for radium research work is nearly completed. This institute will be of international character, at the service of scientists from any part of the world. The Austro-Hungarian government has assumed the cost of maintenance.

All Slime Treatment of Ore in Cyanide Plants

No One System Suitable for All Ores. Rough Separation of Slimes and Sands Advocated. Modified Pachuca Tank. Efficiency Index

BY H. A. MEGRAW*

The present methods by which ores are ground to a point where the best results are obtained by agitation of the pulp will stand careful investigation as to whether or not they present the ideal, or even the best possible metallurgical practice. Each metallurgical problem has its own solution and the most practical mode of treatment may not exactly coincide with anything previously done. It seems unreasonable to accept any one system, however widely followed, as applicable to all more or less similar conditions. This applies with equal force to the practice of total sliming, or that which is called total sliming, for cyanide treatment.

Attention has been called recently to the statement that it may not be good metallurgical practice to treat as slime that portion of the finely ground pulp which really is not a true slime. This does not bring up again the old and much argued question of what constitutes a true slime, but makes necessary an entirely new definition, namely, the dividing of the pulp in two portions: That which is best treated by agitation, and that which is best treated by some other means. That portion which is considered treatable by agitation may be called slime and may contain almost any conceivable proportion of sand in different degrees of fineness. The fact that the slime portion contains fine sand does not necessarily interfere with its treatment by agitation. In making this statement, however, it is to be understood that treatment by the most modern methods is implied. If slime is treated by the decantation method and agitated in tanks having mechanically revolved paddles or arms, it is absolutely necessary to exclude even the finest sand, for the fine sand, once settled, is difficult to raise from the bottom of the tank, and is likely to break or bend the agitator arms or cause mechanical damage at the point of greatest weakness. Agitation by compressed air, however, does not present these mechanical difficulties and the sand may be successfully agitated, provided it is ground fine enough to be kept in suspension by the air current.

Degree of Fineness

The degree of fineness to which an ore must be ground to give the best economical results can only be determined by careful experiment on the particular ore in question. E. M. Hamilton has arrived at the conclusion that it may be more economical to separate a portion or all of the fine sand and treat it by leaching. Mr. Hamilton is undoubtedly correct when he argues that equally good results cannot always be obtained by treating different classes of pulp in one and the same way. Coarse material will generally require more cyanide and more time for the proper extraction of its content. In my opinion it is doubtful, at least in some cases, whether leaching of the coarse portions is really the correct or most economical way of treating such pulp. Mr. Hamilton places the weight of his argument on the premise that fine grinding costs more than separation and leaching of the sand. This may be true in some cases where fine grinding is taken to mean the passing of the entire pulp through a 200-mesh screen. However, when it is taken into consideration that fine sand, up to a certain point, may be treated by air agitation, it is questionable if the finer grinding is really more expensive. In some cases, I venture to say, the economical limit reached by fine grinding and agitation of the entire product will not cost as much as classification and leaching the sand.

Treatment of Sands

I believe, too, that the cost of very fine grinding is being reduced rapidly by new machinery devised for that particular purpose. Considering that the leaching process requires additional plant capacity, sand tanks, etc., and involves the use of separate and stronger solutions and introduces the problem of moving sand, it is not by any means certain that it is generally cheaper. Generally the sand is collected in a collecting tank, where it may or may not receive partial treatment. It then has to be transferred to the treatment tank where treatment is finished. After that comes the problem of discharging the waste sand. Where water is scarce this is not a cheap problem to solve. The Blaisdell excavators and distributors offer economies in handling sand, but the installation cost is high, and this means of mechanical handling can hardly compare with the gravity flow of a well designed plant where all the pulp is treated as a slime.

Mr. Hamilton suggests a system of sand-tank filling in which the pulp is delivered to the sand tank at the extreme outside, the pulp falling upon the sides or staves of the tank, thus building up the sand at the outside and allowing the solution and slime to overflow through a discharge in the center of the tank. This system works well where the leaching system is considered necessary. The same idea in slightly different form has been used in several places. Another modification of the same idea has been used at the San Prospero mill of the Guanajuato Development Company. In this case the distributor consisted of two arms only, delivering the pulp at the outer periphery of the tank and overflowing through a central weir which carried off the solution and whatever slime came with the sand. This pulp was the product of cone classification and did not carry sufficient solution to insure the thorough carrying away of the slime, so a sprinkler arrangement was fixed in the center of the tank, similar to an ordinary lawn sprinkler. This furnished a spray of solution, thus assisting in washing away whatever slime might tend to settle in the charge. The sprinkler could be made to throw solution on any part of the charge by raising or lowering it.

It is practically impossible to make a product consisting entirely of true slime, and equally impossible to make one consisting entirely of clean sand; therefore, the problem is to select that process which will give the best results, either by separating the product or treating it all in one class. Some slime must be made, and this cannot be leached; therefore, it is manifestly impossible to have a product consisting entirely of sand or treatable by percolation. There are two alternatives: First, to separate, leach the sand and agitate the slime; and second, regrind the whole pulp to a point where air agitation of the whole is practical and efficient. Generally speaking, a finely divided ore will give a better extraction than one not so finely ground. There are exceptions, but they must be treated as exceptions and their destiny worked out separately. It seems to me that a system might be devised to avoid the unfavorable features both of sand leaching and of agitating several classes of pulp in a way not fitted to one or more of them. With this end in view I am led to suggest the following:

A rough separation with the object of sending the true slime and the finely ground sand (which can be treated in the same way and in the same time) to be treated by agitation in the cone-bottom (Pachuca) tank. The remaining portion, consisting of sand not so fine as in the first class, but which is fine enough to be kept in suspension in the tank, is to be sent to another tank or system of tanks

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and treated by the same, or slightly stronger, solution for such additional time as may be found necessary to secure the most economical maximum extraction. This would avoid the installation of a separate leaching plant with its necessarily stronger solution and problems of sand handling and have the advantage of a proper treatment of the slightly coarser material.

Proposed Tank

In connection with this I am led to suggest a tank, similar to the Pachuca, which I have designed for meeting the conditions imposed by the treatment of this slightly coarser material. This tank consists essentially of a frustum of a cone superimposed on a conical bottom, instead of the cylinder used in the Pachuca tank. By the use of this design a more constricted space is possible toward the bottom of the tank, allowing less chance for settling. It also allows a lower tank for the same capacity; it fulfils all the requirements of the Pachuca tank, requires less power for agitation and also saves a large amount of excavation for installation where fall has to be considered. The slope of the sides of the frustum may be whatever seems best adapted to the circumstances. This tank has worked well experimentally and can be used for ordinary slime treatment as well, especially where it is advisable to save grade.

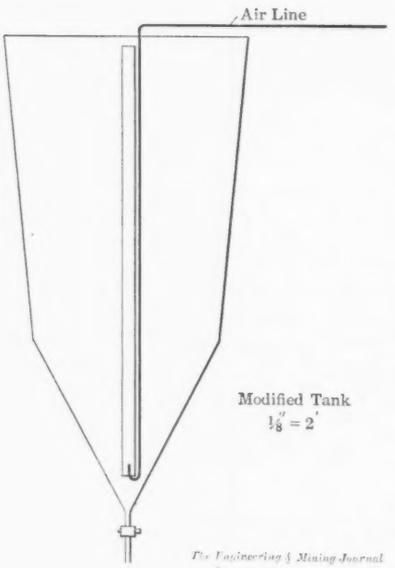
Economy and Efficiency

It is not altogether a technical question as to the application of the best process but, as Mr. Hamilton has suggested, largely a business proposition and the cheapest process, compared with extraction, is the one which must be used. There are cases where leaching cannot be followed profitably, not only on account of extraction but for other reasons. Edgar A. Collins has called attention to a case at Tonopah, where the slime cake formed in the vacuum filter was impermeable and could not be washed except when it contained a certain portion of fine sand, making the cake more porous. It was also shown that fine grinding was necessary to secure good extraction. Mr. Collins states that the economical limit of fine grinding was determined by two factors, namely, the cost of grinding and the difficulty of concentrating the slime, without which it was impossible to cyanide the ore successfully.

The matter of fine grinding has to be reckoned with, but it is being accomplished at costs which are considered satisfactory and economical. In regard to the difficulty of concentrating the slime it would appear that there might be ways of overcoming the difficulty. There are methods and machines which have been successful in some places, blankets, vanners, etc., and the cement *planilla,* such as used at the Pinguico mill at Guanajuato. However, even in case concentration is not complete, it is not altogether clear why cyaniding should not be successful, unless the ore contains some elements other than sulphides, which oppose successful results. I am at present successfully cyaniding an ore in which all the silver occurs as sulphide and I do not attempt to concentrate the slime at all, carrying it directly from classifiers to the slime plant. I should state in this connection, though, that the plant was built for separate treatment and the sands are concentrated.

Efficiency Index

There are also instances of plants where pyritic silver-gold concentrates are successfully cyanided by using a strong



Tank for Sand Treatment

solution together with fine grinding and long treatment. However, the plan of treatment will have to be determined with factors of dollars and cents. It is an easy matter to figure it out mathematically. To calculate it in this way, let A equal the cost of treatment, including milling, grinding and cyaniding in all its branches; and X equal the per cent. extraction; then $100 - X = Y$, or the amount, in per cent., left in the tailings. Then we can say that AY equals the index of the process, and the smaller the index the more efficient the process.

The efficiency may vary from a point where the cost is infinite and the amount left in the tailing is 100 per cent., to a point where the cost is nothing and the amount left in the tailing is 0 per cent. In this way compare two processes, the first with a cost of $4 and an extraction of 85 per cent., and the second with a cost of $3 and an extraction of 70 per cent.

In the first place AY, or $4 \times 15 = 60$, and in the second AY, or $3 \times 30 = 90$, showing that the first process is more economical than the second. All business considerations require economy and efficiency combined, and the process which best gives this combination is the one which will survive.

Mexican Mining Taxes

The reports on the Santa Gertrudis mine estimate the total tax cost on the output as 7 per cent. of the gross. This may be taken as a fair indication of the tax burden on mining in Mexico, presumably calculated from reliable data. The various taxes on mining in Mexico range from 6 to 11 per cent. of the gross output, according to estimates made by engineers. This is less than the Cobalt royalty tax of 10 per cent. on the gross, but is much more than the tax in most of the American mining districts. The levying of what is practically a percentage on the gross output of the Mexican mines is a tax that bears disproportionately on the low-grade properties, and undoubtedly hinders the development of some whereof the margin is small.

There is a good deal of interest in the question of the tax on mining operations in Mexico. It has been figured that the taxes come to 6 to 10 per cent. of the gross output, varying in the different districts. This included the federal coinage tax, or export tax, on the precious metals, the numerous stamp taxes levied on the transaction of business and the local state taxes, sometimes levied as a percentage of the salary roll. In the state of Hidalgo this is as much as 3 per cent. of the salary and pay roll.

In most of the Mexican camps the companies get together and form an *iguala,* which is a division of the tax among themselves, and submit to the government a statement of the gross amount of taxes they propose to pay for the year. On the approval of this gross amount by the authorities the mining companies apportion it among themselves *pro rata,* so the official records do not show what is paid by each company. The *iguala* often results in reducing the taxes, as the government is willing to make some concession in view of the prompt payment and saving in cost of collection.

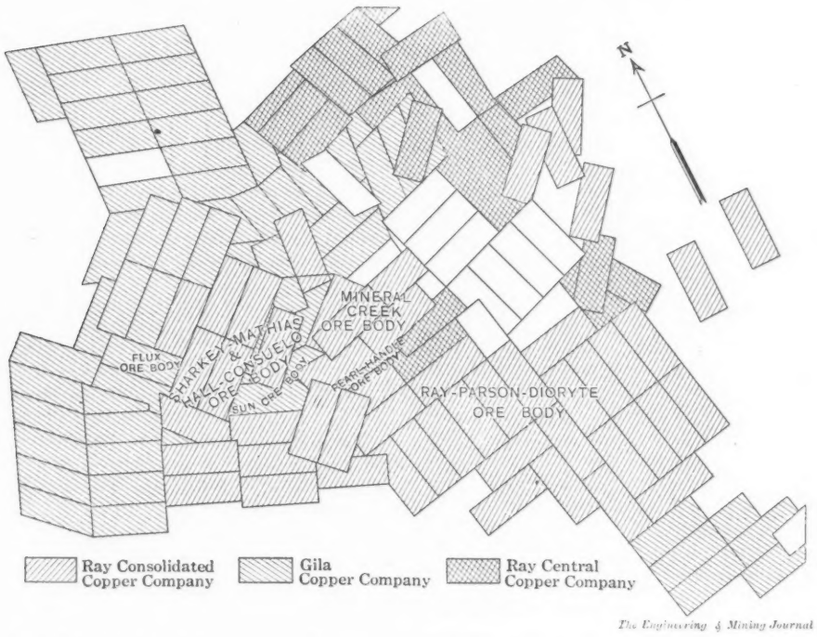
Copper in Panama

Since the Americans have established themselves at Panama in connection with the canal, the country has been more or less explored for minerals. A San Francisco company has discovered a copper deposit north of the canal, which is said to be extensive. The company is planning to explore it further. Some gold properties also have been found, but no definite results have yet been obtained.

Gila Copper Company

In the first annual report of the Gila Copper Company, Ray, Arizona, the operations of that company are reviewed from the date of organization, Feb. 25, 1907, to Dec. 18, 1909. The Gila company was organized to purchase claims in the Ray district which the English owners would not consent to sell to the Ray Consolidated until a certain amount of financing had been done.

A map of the claims of the two companies accompanies the report and is reproduced here. As it is not consistent with economic mining for the Gila to separately equip and operate its detached groups, aggregating about 40 acres, which are partially or entirely surrounded by the Ray Consolidated, an agreement was made with that company for a determination of the extent and value of the orebodies in these areas and their conveyance to the Ray Consolidated either for cash or in exchange for an area adjoining the main body of Gila territory and proved to contain an equal value of ore.



MAP SHOWING PROPERTY AND OREBODIES OF RAY CONSOLIDATED, GILA AND RAY CENTRAL

PROPERTY AND DEVELOPMENT

In connection with the above contract, and because of the determinations which can be made in conjunction with the drill holes in Ray Consolidated territory immediately adjoining Gila ground, the principal drilling to date has been done at the points marked Sun and Pearl Handle orebodies, which are the main areas embraced in this contract. Development by drilling has been started on the main territory of the Gila.

The company owns about 950 acres of lode claims adjoining the Ray Consolidated on the north, west and south, except for the groups above mentioned which are more or less isolated and included within the Consolidated boundaries.

The mineralized belt has a northwesterly and southeasterly maximum length of about 2½ miles and a maximum width of about ¾ mile. The ore occurs as the mineralization of a much fractured and silicified schist, and is found as a bed overlain by a capping of leached and comparatively valueless rock. About 275 acres of more or less mineralized schist is included within the Gila territory, classified by Spurr & Cox as 110 acres of ground showing thorough primary mineralization and 165 acres of less mineralized ground. The areas of maximum primary mineralization are said to correspond in general with those of maximum secondary ore formation, and it is assumed that a large proportion of the 110 acres alluded to will develop commercial ore.

Soon after the acquisition of the property 3000 ft. of underground workings and 6000 ft. of churn drilling were done, indicating the presence [not blocking out] of 800,000 tons of ore. Work was stopped until July, 1909, and then renewed, so that at the date of this report there were, in addition to the underground workings, 50 drill holes aggregating over 21,000 ft. of drilling on the property. On Dec. 1, 1909, the data deemed necessary to final valuation was completed on 44 of these holes. Of these, 33 contain commercial ore, but only 29 enter into Mr. Jackling's statement of tonnage developed. No ore is considered fully developed unless the holes representing it can be connected up so as to form completely sounded areas by drawing lines between holes not to exceed 200 ft. apart. In this manner he estimates 12,237,000 tons of developed ore having an average copper content of 2.05 per cent. This is included in 19.7 acres. Of this ore 10,500,000 tons are in the Sun orebody. The average thickness of capping is 306 ft., and the ore is 177 ft. thick.

There is in addition a large tonnage of partly developed ore and developments are still continuing at the rate that has developed ore to the extent of from 1,500,000 to 2,000,000 tons per month for the last four months. In addition to its own work, the Gila company has access by agreement to the results of work on the Ray Consolidated, and can thus direct its policy by the knowledge gained by that company.

Cape Copper Company

The report of the directors of the Cape Copper Company covering the year ended April 30, 1909, as regards the Cape Colony accounts, and the year ended Aug. 31 as regards the London and Newfoundland accounts, has been issued. The net profit amounted to £90,223, as compared with £144,366 of the previous year. The principal factor causing a reduction in the profits was the closing of the company's smelting works in South Wales for 16 weeks on account of labor troubles.

In Cape Colony the output from O'okiep mine was 15,968 tons, containing 246,706 units of copper. The estimate of reserves of mineral in the mine is returned as 10,000 tons assaying 20 per cent. copper. At Nababeep, 54,000 tons of 5.04 per cent. copper ore were sent to the local smelting works. The ore reserves amount to 150,000 tons carrying 5 per cent. copper. At the smelting works, 82,099 tons of ore were smelted. The matte produced averaged 49.5 per cent. copper.

The company is working several "trial" mines in Cape Colony as well as one in India and one under option in America. The suction-gas plant installed at O'okiep has effected a reduction of 46 per cent. in the coal consumption compared with that in the previous year. The operations at the Tilt Cove establishment in Newfoundland to Dec. 31, 1908, resulted in a net profit of £21,323, one-half of which was paid to the Tilt Cove Copper Company and the other half was credited to the Cape Copper Company. The output of the mines was 36,981 tons averaging about 3½ per cent. copper and costing about $1.88 per ton. The shipments for the year were 34,216 tons. The ore reserves are estimated at 33,000 tons.

The Keedy Sizer for Classifying Complex Ores

Diametric Sizing an Essential to Specific Gravity Separations; a Machine Which Aims to Do This at Low Power and Maintenance Cost

BY CARL F. DIETZ AND DYKE V. KEEDY *

One of the most interesting and important problems in ore dressing, and one that has long occupied the attention of many able men, is that of recovering zinc from complex ores. An enormous amount of time and money has been spent in original research work, and much good has been done. Various methods have been tried and some have met with considerable success; notably by first roasting the ore to render the iron sulphide more magnetic than the ferruginous black jack and then subjecting the mass to the separating influence of some type of magnetic machine. In this process there are several difficulties which prevent a full measure of success. One important difficulty is that of securing a uniform roast and another is that of handling the fines; but notwithstanding these deterring factors the results obtained have, in some noted instances, been very gratifying and profitable, especially when the ore was sized before magnetic treatment.

Close Sizing Essential

So far as we know, the most efficient method of making a separation of zinc and iron sulphide is one based upon specific gravity differences and which will hereinafter be described. In the treatment of ore by any process depending upon differences in specific gravity to effect separation, it is well known that the measure of success to be obtained depends directly upon the degree of accuracy and the closeness of the grading by size of the ground ore; and even in the most primitive methods by which materials of the widest differences in specific gravity are to be separated, at least some effort is made in the way of classification by size.

In direct proportion as ore becomes complex and specific gravity differences become narrower, the necessity for close and accurate sizing increases. All millmen realize keenly the advantages to be obtained by having their material closely sized before going further to any kind of a separating machine, and for this purpose there have been devised and put into use a large number of types of shaking, impact, vibrating and belt screens. All of these have met with more or less success, but all operators using machines of this kind have found that their difficulties are greatly increased as they approach the grading of the finer sizes.

The common method of grading ore which is ground too fine to be successfully handled by trommels, is by various kinds of hydraulic and, in some cases, pneumatic classification. The widest stretch of imagination cannot characterize the products of such methods of so-called sizing as being anything better than an approximation to the desired end. These graded products are made only as a result of the difference in weight of the particles (although somewhat influenced or modified by their shape and by their projected areas, offering more or less resistance to settling against the flow of the medium, whether air or water), and for this reason it must be admitted that all hydraulic or pneumatic classification is only an approach to sizing and differs widely indeed from diametric sizing in which the particles are measured by the screen aperture, specific gravity playing no part. A further and more complete discussion of the above is in process of preparation and will appear shortly.

Other things being even (we have here in mind the commercial and practical features), it goes without saying that close and accurate diametric sizing is far preferable to any hydraulic classification (which must, of necessity, be only indifferent sizing), because, assuming that all the particles in any given grade are practically of the same size or diameter, the influence of specific gravity difference, which is afterward employed to effect separation, then has the most free and uninterrupted opportunity to exert itself.

Closeness of Sizing Differs with Ores

Admitting the correctness of the theory that diametric sizing of an ore is necessary as a preliminary step in its concentration and separation, then the questions arise: (1) How far is it necessary to carry this sizing operation? (2) Into how many sizes should the ore be resolved? (3) How wide should be the steps between the various sizes or grades?

Of course the ore must ultimately be ground fine enough to free the mineral particles from each other, and it should be ground in such a way as to produce the minimum of fines. A process of gradual reduction of the sizes, as opposed to a violent smashing of the ore, is in the direction of producing the desired results. With some ores a coarse crushing frees a sufficient percentage of the mineral to admit of a concentration being made to produce commercial results before further or ultimate grinding becomes necessary, and in a few rare instances the ore will break in such a way as to leave the coarser products lean enough to be thrown out as tailings. In some instances the ore will break in such a manner that nearly all the appreciable mineral will report in the sizes coarser than 100 or 150 mesh; but it often happens that a large part, if not the greater part, will report in the sizes finer than 100 mesh and down to 200 or 275 mesh, and in slimes. Hence only upon a study of the screen analysis of the ore can one determine the answers to the first and second questions.

Ratio of Weights Corresponds to Diameters Cubed

Before determining how wide the steps between the grades in sizing should be, one should first consider the character of the ore with respect to the specific gravity difference between the various minerals to be separated, also between the minerals and the associated gangue materials; the narrower these differences, the closer should be the steps between the sizes; the object being to maintain a ratio difference between the sizes as narrow as possible (consistent with good practice and with local conditions), when compared with the ratio differences of specific gravity between the various substances to be separated. In considering the ratio of weights of particles it should be remembered that we are not dealing with perfect cubes or spheres, but we must, for lack of more accurate measurements, consider the particles as having cubical dimensions; hence the ratio of weights will be as the cubes of the diameters.

In every grade there are a number of particles which are only just small enough to permit them to pass through the coarse screen limiting this grade on one side; there are other particles only just a trifle too large to admit of their passage through the fine screen limiting this grade on the other side; but between these two extremes there is an indefinite number of particles of practically identical size.

Ratios of Sizes and Specific Gravities Compared

To be able to make comparison between the ratios of size and the ratios of specific gravities of the particles we must ascertain by accurate measurement the size of the apertures of the screen, and then by taking the cubes of the diameters we can make the comparison desired. To illustrate: We have before us the problem of the separation of zinc blende (sp.gr. 3.9) and fluorspar (sp.gr. 3), ratio 1.3 : 1. Suppose we are screening through 50-mesh screen (size of aperture 0.0146 in.)

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and on 60-mesh screen (size of aperture 0.0114 in.). The cube of 0.0146 is 0.000003112136, and the cube of 0.0114 is 0.000001481544, ratio 2.1:1. We find here so wide a difference that it is evident we could expect to find a considerable percentage of unsized particles (unsized with respect to gravity ratio) in this particular stock or grade. This unsized material would, in proportion to its percentage by weight, be sufficient to partly nullify or offset the specific-gravity differences, so that this portion of this particular stock would consequently fail to respond to the separating influences afterward brought to bear to produce a separation; and such portion of the stock would necessarily report as a middlings product.

But suppose we are screening through a 56-mesh on 60-mesh instead of through 50 on 60. Here we would have in the 56-mesh an aperture of 0.0125 in., the cube of which is 0.000001953125, which when compared with the cube of 60-mesh (0.000001481544), shows a ratio of 1.25 : 1. In this case the ratio of the largest to the smallest particles to be found in that particular stock, would be less than the ratio between the specific gravities of the substances to be separated and, theoretically, there should therefore be no middlings product on the table.

In the separation of iron pyrite (sp.gr. 4.8) and blende (sp.gr. 3.9) we have a ratio difference in specific gravity of 1.23 : 1, which would theoretically call for a closer sizing than would the ratio 1.3 :1, referred to above. One should bear in mind that the percentage by weight of these "unsized particles" in the stock is relatively small, as compared with the whole, and the figures given above are purely for illustrative purposes and represent ideal conditions.

In this connection we may consider the minerals which one is often called upon to separate and which are sometimes all to be found in one ore: Galena (sp.gr. 7.25—7.35), iron sulphide (sp.gr. 4.8—5.2), zinc sulphide (sp.gr. 3.9—4.2), fluorspar (sp.gr. 3—3.25), calcite (sp.gr. 2.5—2.8), silica (sp.gr. 2.5—2.8). In the matter of separating galena from zinc sulphide we find the ratio of specific gravity to be 1.86:1. Should this be sized, as before considered, say through 56 on 60, where the ratio of the largest to the smallest particle is 1.25:1, then theoretically an absolutely perfect separation would result from table operations and without a middlings product, and the figures indicate that sizing need not be carried so far for zinc-lead as for zinc-iron separations, which is corroborated by practice.

However, there are practical factors which tend to modify theoretical perfection: the ore will not break in perfect spheres or cubes; and in the screening process some particles will be present which may have one certain dimension which would permit or prevent their passage through a certain mesh aperture, and these particles in consequence will report in one certain grade when, in fact, their respective total cubical content would properly classify them as belonging in another grade.

In the separation of iron sulphide and zinc sulphide we have to deal with a ratio of 1.23:1 in specific gravity; therefore a zinc particle need be only 23 per cent. greater volumetrically to weigh the same as the iron. In this case it is obvious that close and accurate diametric sizing must be done to avoid making an excess amount of middlings or to effect a table separation at all satisfactory.

Accurate Sizing Makes Good Separation

In operating any table, either wet or dry, or any separating device in the operation of which specific gravity difference is the main factor controlling the separation, and when a grade of stock is used in which the ratio of the largest to the smallest particle exceeds the ratio of the specific gravity difference, it means that middlings are absolutely unavoidable. The percentage of middlings made depends mostly upon the difference between the gravity and size ratios. Moreover, the finished products coming from the separator under such conditions will, necessarily, be contaminated by the other constituents of the ore to a greater or less degree, depending upon the ratio of difference in size of the particles in the particular stock which is being treated and will also be affected to some extent by the tendency and ability of the table or other separating machine to indifferently grade by size, an unsized stock. In other words, the requirements of efficient separation and of sizing in the same operation are mutually incompatible, because founded upon opposing principles.

It is the inefficiency of the various hydraulic or pneumatic systems of classification used in lieu of screens, which accounts for the inability of any of the wet mills throughout the country (most of which depend upon some system of hydraulic classification) to satisfactorily separate zinc from iron, and which has caused the building up of huge dumps of zinc-iron middlings. Had the ore been properly sized before passing to the tables, these dumps would have had no excuse for existing.

When the usual hydraulically classified pulp is fed to a table, the difference in size between the largest and smallest particles does not permit gravity differences to become effective excepting where such gravity differences are extremely great, and the inevitable result is a wide zone of accidental middlings such as zinc and iron, or zinc and gangue with an indifferent finished product lying between these middlings zones.

If ore which has been closely sized diametrically is fed to a table, either wet or dry, the immediate effect will be to stratify the minerals of varying specific gravities horizontally into distinct zones, leaving between these zones only a very narrow streak of true middlings.

The capacity of a table thus fed will be almost doubled as a long series of tests has proved, largely due to the fact that so many differently sized particles are not compelled to scramble for their natural positions, but immediately group themselves where their specific gravities would naturally tend to place them. In this we are only, by removing obstacles, materially assisting natural fundamental law.

Graded Screens Impractical for Close Sizing

While all practical millmen keenly realize the advantages to be gained from accurate and close sizing, the efforts they have made to follow their convictions have necessarily been limited by commercial factors. It can be readily appreciated that a battery of shaking or vibrating screens, extensive enough to produce the necessary tonnage of ore, graded into a sufficient number of sizes to be of really marked advantage, would mean adding to milling systems many weak links and a multiplicity of parts, requiring much attention, necessitating many adjustments and calling for almost constant renewals.

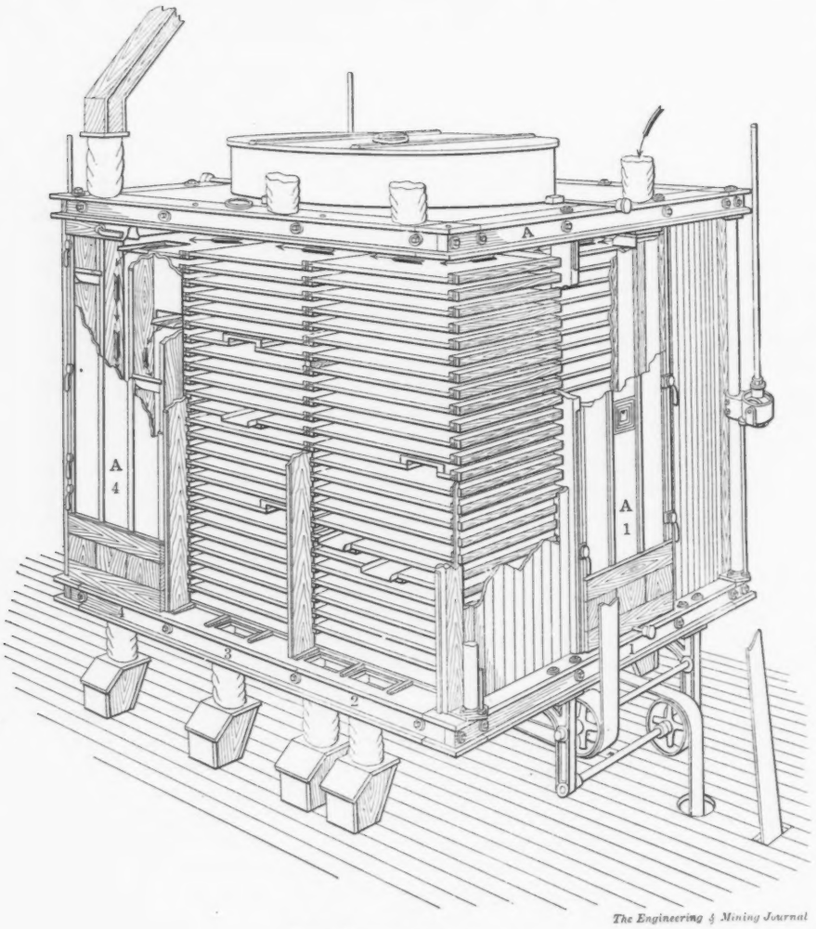
Many such additions have been made and they were found to be impractical and commercially impossible. Some have met with partial success, but in the long run the thousands of screen troubles have served to compel the millmen to try to get along with as small a number of grades of screened ore as possible, or to adopt some hydraulic system of classification as a lesser and therefore more tolerable evil, even though this should result in a lower grade of finished products, a loss of mineral in the tailings and the building up of middlings dumps.

Realizing the general attitude of the milling fraternity on these points and admitting the correctness of its views, when considering the various forms of apparatus offered in the market it is manifest that the above named difficulties should be removed, not merely in the sense of a laboratory success, but keeping in mind the all-important factor of commercial practicability.

About 10 years ago John E. Dwight was engaged in an effort to solve the problem of separating zinc sulphide from a complex ore at Warren, N. H. He was doing this work on a magnetic machine, after first subjecting the ore to a slight roast to render the iron magnetic. After sizing the material the results obtained on the magnetic machine were so much better than before sizing that there was then commenced a long series of attempts which finally resulted in the evolution of the present Keedy ore sizer.

Design and Construction

This machine was developed from the underlying principles of the bolting machine used by flour millers. It was so designed as to meet the much more severe requirements of ore dressing and the severe strain of wear and tear which the machine could be called upon to endure was always kept in mind. All running parts had to be reduced to a minimum in number and those which could not be dispensed with had to be properly protected from dust, yet they had to be easy of access and simple in design.



The Keedy Ore Sizer

In the various sizes in which the machine is built, it contains from 96 to 208 screens, each 20x20 in., so that no waste of screen cloth occurs in cutting screens to the desired dimensions. The screens are placed in layers or rows of 8 on a level, or in one turn around the machine; each screen is slightly lower than the one preceding, so that as a whole they constitute a spiral path over which the ore travels round and round through the machine to the final outlet for the extreme fines, which in some cases is as fine as through a 275-mesh screen.

The ore, on entering the machine, first strikes a coarse or scalping screen to remove the first oversize or debris, then passes to the first coarse-screen series; at the end of this series the oversize, being by this time freed from all undersize, encounters a cutout spout and the finished product passes out of the system and into its own receiving bin below. The next finer grade is treated in the same manner, until finally the extreme fines product passes out. By cutting out the large sizes first, the load upon the finer screens is materially lessened and there is a consequent saving of the wear and tear on the finer cloths. Means are provided whereby the screens are thoroughly kept from blinding.

The machine is about 6x6 ft. and from 4 to 6 ft. deep in its various size numbers; it can be operated in a space 10 or 12 feet square. The machine is automatically balanced and is without a trampot or any other connections with the floor. It is swung from overhead on oscillating rods and there is no jar when starting or stopping. It runs freely and without noise. It is absolutely dust proof.

Excessive wear is averted by a construction providing that ore shall not strike any part of the interior of the machine except when the material is harder than the ore itself, or upon soft rubber (which well resists wear of this sort), or upon a bed of its own material or the surface of the screen. Wire cloth is used for screens down as fine as 90 mesh; for finer sizes, silk bolting cloth as fine as 275 mesh is used if the character of the ore demands such fine screens.

The motion is gyratory; there is no jar, no vibration and no wasted energy as opposed to any and all reciprocating or vibrating motions. The screen frames are placed horizontally, so that the projected areas of the apertures correspond with their actual dimensions.

The travel of the pulp over the screens is a complex series of curves, as opposed to the straight-line travel over inclined screens. The pulp, therefore, travels further over the same given screen area, and as it remains longer on the surface of the screens, the opportunities offered the undersized particles to pass through are vastly multiplied; concurrently, the capacity of the screen area is largely increased. The capacity of the screen area is further relatively increased by reason of the fact that a certain load of pulp is at all times being carried on the horizontal surface of the screen and, though it may be sometimes not over ¼ in. deep, it lies flat on the screens and the overburden thus assists the undersized particles in their passage through the apertures.

Capacity

The Keedy sizer is a machine for which is claimed a maximum of efficiency and capacity, minimum of wear and tear and least expenditure of power in resolving the ground ore at one operation into any desired number of grades by size, up to 20. The screens may range from, say, 12 mesh to 200 or 275 mesh. This work is done with an efficiency so complete that there is no practical evidence of oversize or undersize present when any one grade is being treated, either on a wet or dry table.

The capacity in tons per hour is variable and is dependent upon several factors: (1) The physical character of the ore and the form in which the particles report themselves. Some ores will respond to screening influences far more readily than others. (2) The degree of fineness of the ore has much influence upon capacity. It is obvious that a greater tonnage of coarser sizes will pass a screen in a given unit of time. (3) The number of grades or sizes into which it is desired to resolve the ore. A given area will grade a greater tonnage of ore into 4 sizes than into 16 in a given unit of time.

At Eureka, Utah, one Keedy sizer was operated at the rate of 4 tons per hour; resolving the ore into 10 sizes plus the oversize and undersize, or 12 sizes in all. Repeated tests revealed an efficiency above 90 per cent. At another plant and on another ore, 4 Keedy sizers are regularly running at the rate of 2 1/3 tons

each per hour, separating the ore into 15 sizes in all.

Power

Power is an important factor in most cases and it becomes necessary to take this item of the cost into full consideration. The Keedy sizer requires only about 1 h.p. and will handle a greater tonnage of ore per unit of time and with less power than will a whole battery of shaking or impact screens, even though it be granted that each screen unit in the battery will produce two or three sizes at one operation. All such screens depend largely upon a sharp impact or upon a sharp reversal of motion for the passage of particles through the screen apertures.

In the former case impact means noise and noise means loss of power, since the force between two striking bodies must be either taken up by the mass of the bodies or transmitted to springs. The force applied in the form of blows means a shock to the material suffering the blow and consequently aggravating wear and loosening of bolts and screws, resulting in general deterioration and dilapidation.

In the latter case the forces are exerted in bringing the reciprocating mass momentarily to rest, and then reversing the direction of the movement. Such a method produces wear and strains which can be absorbed only by sufficient mass in the parts; it also means a large consumption of energy with comparatively small resulting benefit. The main objections to shaking and impact screens, as a class, are found in the three following reasons:

(1) On account of the inclination of the screen necessary to make the ore travel, the screen aperture does not truly measure the size of the particle passing through or staying on the screen; it is the projected area of the aperture which is the approximate measure.

(2) When considering that the power supply is uniformly of rotary character, it is obvious that transformation into rectilinear motion may result in expenditure and loss of power; it necessitates much complexity of construction, involving the use of ecentrics or some other transforming device.

(3) The ore travels over the screen linearly and has a strong tendency to skip, so that during only a small part of the short time that the ore is traveling over the surface of the screen does it actually come in contact with the screen; hence the invitations received by the undersized particles to pass the apertures are lessened in number and less likely of acceptance.

Cost of Screen Renewals

The cost of screen renewals per ton of crude ore is variable, depending upon several factors: (1) The degree of hardness of the ore and the form of its crystals, when broken; (2) the number of sizes into which the ore is to be graded and the consequent difference in the area of cloth required; (3) the relative percentage by weight of the fine sizes, as compared with the coarser sizes.

In the mill which was operated by the Cactus Ore Company at Eureka, Utah, and where the ore was being graded into 12 sizes and where the ore was extremely hard and sharp, the cost of screen renewals was about 8 to 10c. per ton. In a mill now being operated in Utah, where the ore is being graded into 15 sizes, but where there is a relatively small percentage of sharp-edged, hard quartz or gangue material, the cost for screen renewals for crude ore milled has been shown to be about 5c. per ton.

Operation in Utah

In the operations at Eureka the pneumatic dry tables, manufactured by Sutton, Steele & Steele, of Dallas, Texas, were used for several reasons: (1) There was not enough water available to permit the use of wet tables; (2) we then regarded the Sutton table as the best dry concentrator on the market, and we have yet to find one which will approach it in capacity and efficiency; and (3) we had to deal with an ore whose silver content was largely in chloride form, and which would be mainly lost in any wet system of concentration.

Because of the fact that the ore from the May Day mine had not been thoroughly tried out by this system, and because the mill at Eureka had been rearranged largely for the purpose of carrying on further experimental tests, an elaborate and thorough system of sampling and assaying was established and carried on.

While the first carload of concentrates was being turned out every separate lot of sized ore which went to make up the carload, was carefully sampled and weighed at several points in the system; also the heads, tails and concentrates of each separate lot as they came from the table were carefully sampled, weighed and assayed. There were nearly 90 of these separate lots, ranging in size from 20 mesh to minus 200 mesh, and over 800 chemical determinations were made.

A record of the actual running time of the sizer and of the Sutton table was also kept. The percentage, by weight, of each grade or size from 20 mesh to minus 200 mesh as produced by the sizer was also noted. The dust coming from the plant and caught in the dust collector was also weighed and its value determined. Some of the salient features shown in the record are summarized in the accompanying table.

The percentage of lead in concentrates (56.58 per cent.), as given in this table, was arrived at by calculating the assay value of the several lots which went to make up the carload. The official assay of concentrates as shown by the smelter's settlement sheet serves as a check to prove the correctness of our chemist's assays. It was as follows: Lead, 56.4 per cent.; silver, 35.8 oz.; gold, 0.06 oz.; Fe, 2.4 per cent.; Zn, 4.7; S, 4.2; Insol., 14.2 per cent.

DRY CONCENTRATION RESULTS.

Number of sizes into which the ore was screened	10
Number of separate lots making up a carload of concentrates	88
The capacity of the Keedy sizer per hour (average)	8000 lb.
Capacity of Sutton table per hour (all sizes)	3000 lb.
Cost of screen renewals per ton of crude ore treated, say	10c.
Cost of fuel and labor for drying the ore per ton (coal at $5)	6 to 8c.
Weight of carload of concentrates	61,359 lb.
Weight of original ore used	382,776 lb.
Degree of concentration	6.23 : 1
Lead in original ore	9.77 per cent.
Lead in concentrates	56.58 per cent.
Recovery of lead	92.77 per cent.
Recovery of silver	75.00 per cent.

Other Tests

While in the operations at Eureka the Sutton dry table was used, it should be understood that though the capacity per hour of a good wet table may be less, yet equally good results can be obtained as has been amply demonstrated by a large number of tests we have made on various ores of widely differing characteristics, using wet tables.

Since the operations at Eureka ceased, we have carried out a number of similar tests on various ores at different places and under widely differing conditions. A long series of interesting and successful tests was carried on by Carl F. Dietz at Storfoshei, Norway, in the summer of 1908, treating iron ore; and it was shown in these that the Sutton table equipped with a specially constructed deck to suit the conditions, did excellent work when being fed at the rate of six tons per hour.

A 50-ton test was carried out in Mexico during the closing month of 1908, the final results showing that a 9.5 per cent. fluorspar-zinc was brought down to 1.1 per cent. fluorspar. In the mill at Eureka, Utah, there was carried out a series of tests on concentrating zinc ores consisting of a mixture of carbonate and silicate with satisfactory results.

During the last year we have spent a great deal of time testing out this system as applied to a separation of blende and flaky specular hematite. The results were sufficiently satisfactory to warrant the construction of a mill to do this work.

In this work we have had excellent success with the James wet table, made by the James Ore Concentrator Company, of Newark, N. J. We have lately made some successful tests in separating zinc, fluorspar and calcite coming from Kentucky, in addition to other tests made on similar ores in Mexico. The Keedy ore sizer is owned and controlled by the Cactus Ore Company, 257 Broadway, New York, and is fully protected by patents.

A Typical River Mine in Pennsylvania

In Order to Provide for the Production of a Large Tonnage, a Rather Uncommon System for Hauling and Handling the Coal Was Installed

BY FLOYD W. PARSONS*

The field of coal, consisting of about 4000 acres of the Pittsburg bed, being opened by the Monongahela River Consolidated Coal and Coke Company at its Crescent mine near California, Penn., lies about three miles from the Monongahela river and the same distance from the Pennsylvania railroad.

The mode of haulage in the old Crescent mine was an endless line, and the entries had never been graded. It was found necessary, in preparing for motor haulage, to regrade one of the entries practically its entire length. As this work was to be done without shutting down the mining operations, this grading was necessarily done at night. The track was torn up as soon as the mine ceased operation in the afternoon and a section of the bottom was blown up, or the roof ripped, as the case might be, and the track relaid in that portion for the next morning.

pit mouths were either concreted or stone arched. There are six main entries in the new coal, three intakes and three returns, two of the intakes being haulage entries and the third a traveling way. The face entries are spaced 1200 ft. centers and on one side of the mine, butt entries are driven in pairs; however, the rooms are to be worked off but one entry, as shown on the sketch. On the other side of the mine, three butt entries are driven, the rooms to be turned off the two outside entries and the middle entry to be used as a return air course.

GENERAL VIEW OF NEW POWER HOUSE WHICH SUPPLIES ELECTRIC CURRENT FOR OPERATING THE CRESCENT MINE

In opening up this coal it was found necessary to use either some of the old entries of the Crescent mine or an overland railroad. It was decided to use one of the Crescent main entries, which is about two miles in length and extends in nearly a straight line from the bottom of the Crescent slope to the outcrop of the coal in Pike Run Hollow. The accompanying map shows the old entry that was used.

From Pike Run to the new coal, a distance of about one mile, 2000 ft. of which is underground, is all new work and no trouble was experienced. All the

The mining is done by undercutting with chain-breast machines. The coal is gathered with 6½-ton gathering locomotives, the motor not leaving the entry. Where necessary, the cars are pulled into

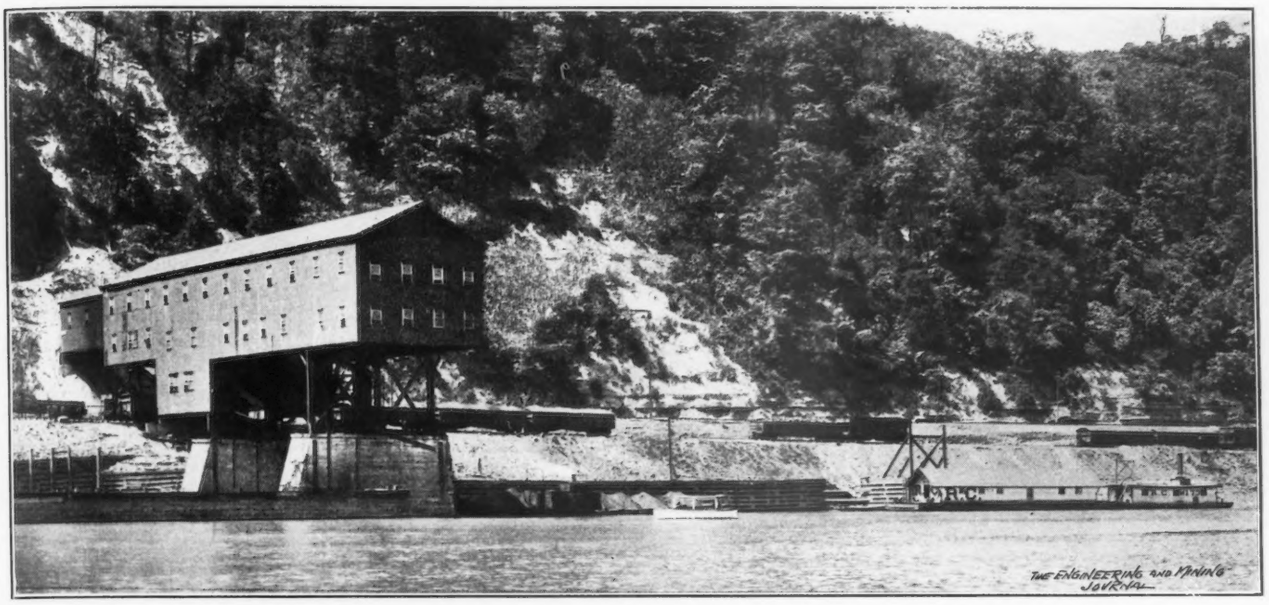
the rooms by the aid of a crab on the locomotive and a snatch block; and are pulled out of the rooms where necessary by a crab.

Twenty-five pound steel rails are used on all butt entries and in rooms. Room turnouts consist of cast-steel frogs, one cast-iron fixed switch point and one rail switch point as shown on the sketch; this switch point is operated by foot. All face entries are laid with 40-lb. iron and the main haulage entries with 60-lb. iron.

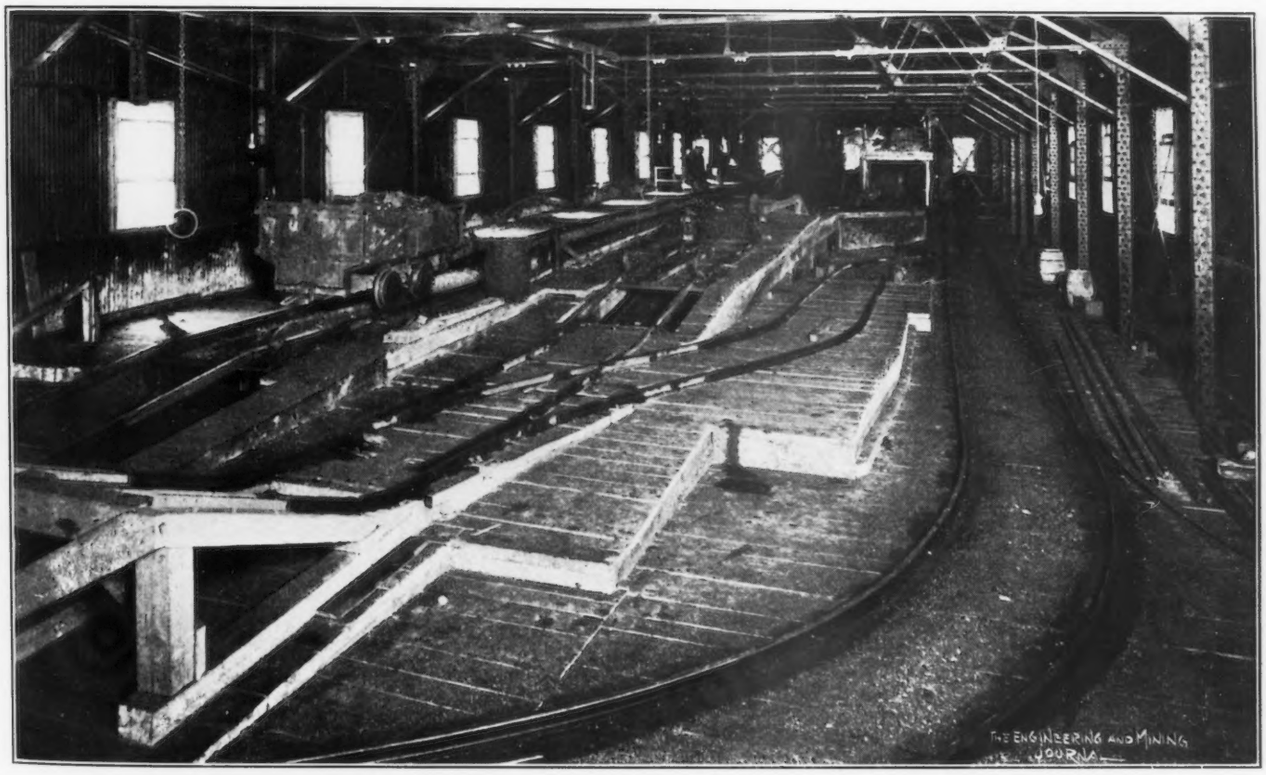
The power plant shown in the accompanying illustration, is situated in Pike Run Hollow, which is about midway between the center of the field of coal and the tipple. There are two 500-h.p. Sterling boilers, two 500-kw. 500-volt d.c. Western Electric generators driven by direct-connected cross-compound Corliss engines.

The Haulage System

The side tracks at the bottom of the slope have a storage capacity of 150 loaded and 135 empty cars. The cars are steel with cast-steel bumpers and

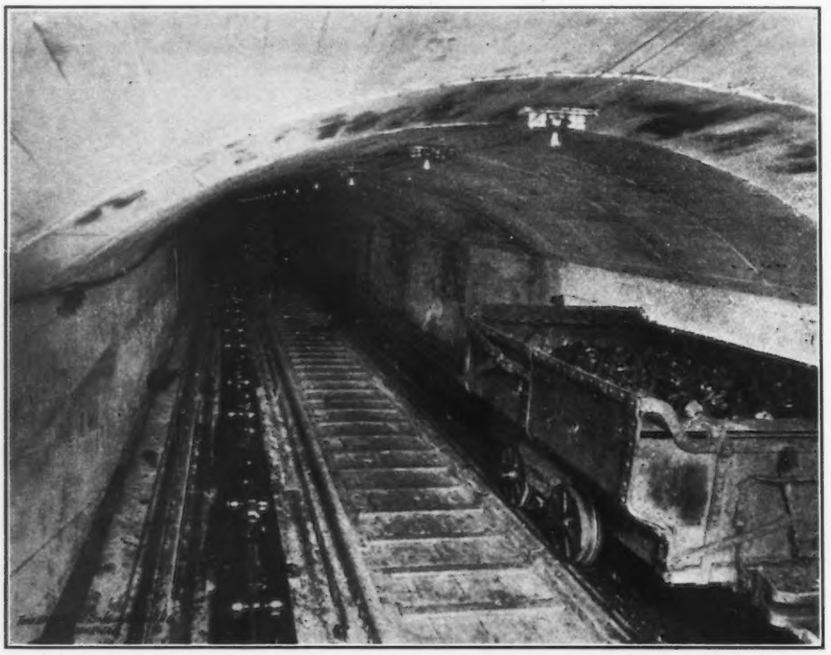


The River Tipple at the Crescent Mine. The Entire Structure Is Fireproof and Every Modern Convenience Has Been Installed



The Tracks and Dumping Arrangements in the Tipple Have Been So Designed That only a Minimum of Labor Is Required

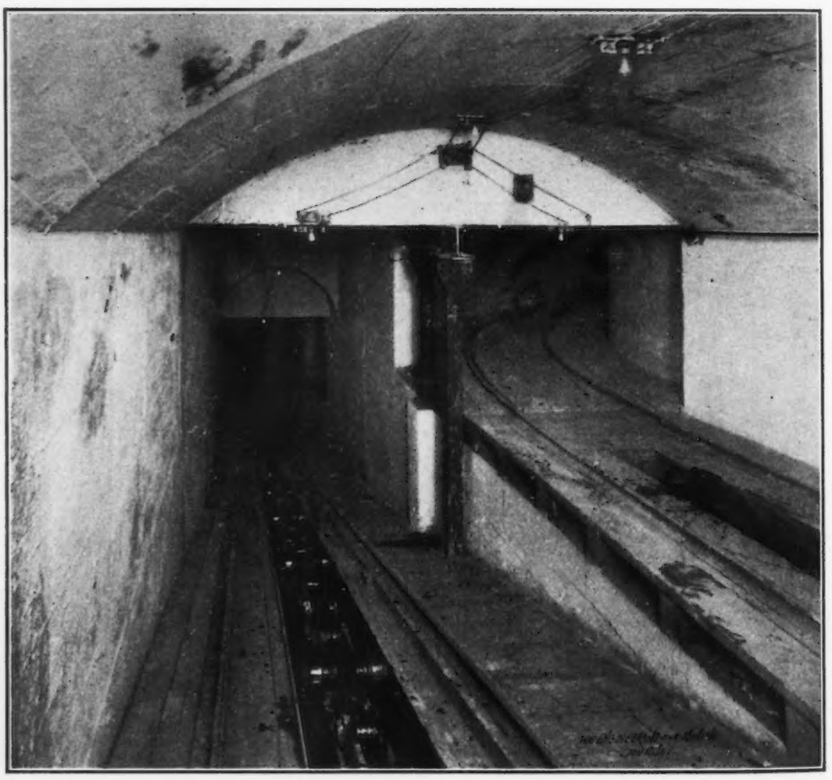
spring draft gear, 32-in. wheel base, weigh 3750 lb. and have a capacity of 3½ tons of coal. They are brought to the bottom of the slope from the inside parting by 20-ton motors in trips of from 80 to 100 cars. They are fed on to the up-haul of the slope by a feed haul driven by a 40-h.p. motor. The up-haul has a capacity of 6 cars per minute and the down-haul a capacity of 12 cars per minute. The slope is 15 ft. wide and 8 ft. high, and is substantially lined throughout its length with concrete. The car-feeder above mentioned not only dispenses with all manual labor at the foot of the slope, except a boy to draw coupling pins as the cars reach the head of the feeder, but greatly lessens the wear and tear on the car haul, as the cars are already accelerated when they reach the foot of it. The up car-haul consists of a heavy steel roller chain with cast-steel hooks to engage attachments on the bottom of the mine cars. It is driven by a 250 h.p. motor, the drive being equipped with band and ratchet brakes which set automatically when no power is being delivered to the motor; this arrangement prevents the cars running back.



SHOWING THE MINE SLOPE WITH DOUBLE-CHAIN HAUL FOR LOADS AND EMPTIES

The empty mine cars are delivered from the tipple to the head of this slope where they are automatically picked up by the empty down-haul and lowered (62 ft. vertically) and delivered to the trip-maker. This down-haul also consists of a heavy steel roller chain with hooks to engage attachments on the bottom of the mine cars. It is geared to the countershaft of the up-haul so that the descending empty cars assist the ascending loaded ones. The entry at the foot of the empty down-haul is driven on a ¾ per cent. favorable grade of sufficient length for 100 cars.

The trip-maker to which the empty cars are delivered at the foot of down-haul consists of an endless steel chain with dogs, driven by a 40-h.p. motor, and automatically receives the empty cars from the down-haul and makes them up in a trip, ready for the mine motor to return them into the mines. The first car reaching the head end of this trip-maker is advanced one car length by the second car reaching this point; the first and second cars are advanced by the third car reaching the point, etc., until 100 cars are in the trip. This car-haulage system, which was designed and built by the Heyl & Patterson Company, of Pittsburg, is notable for the small amount of labor required in its handling of the mine cars.

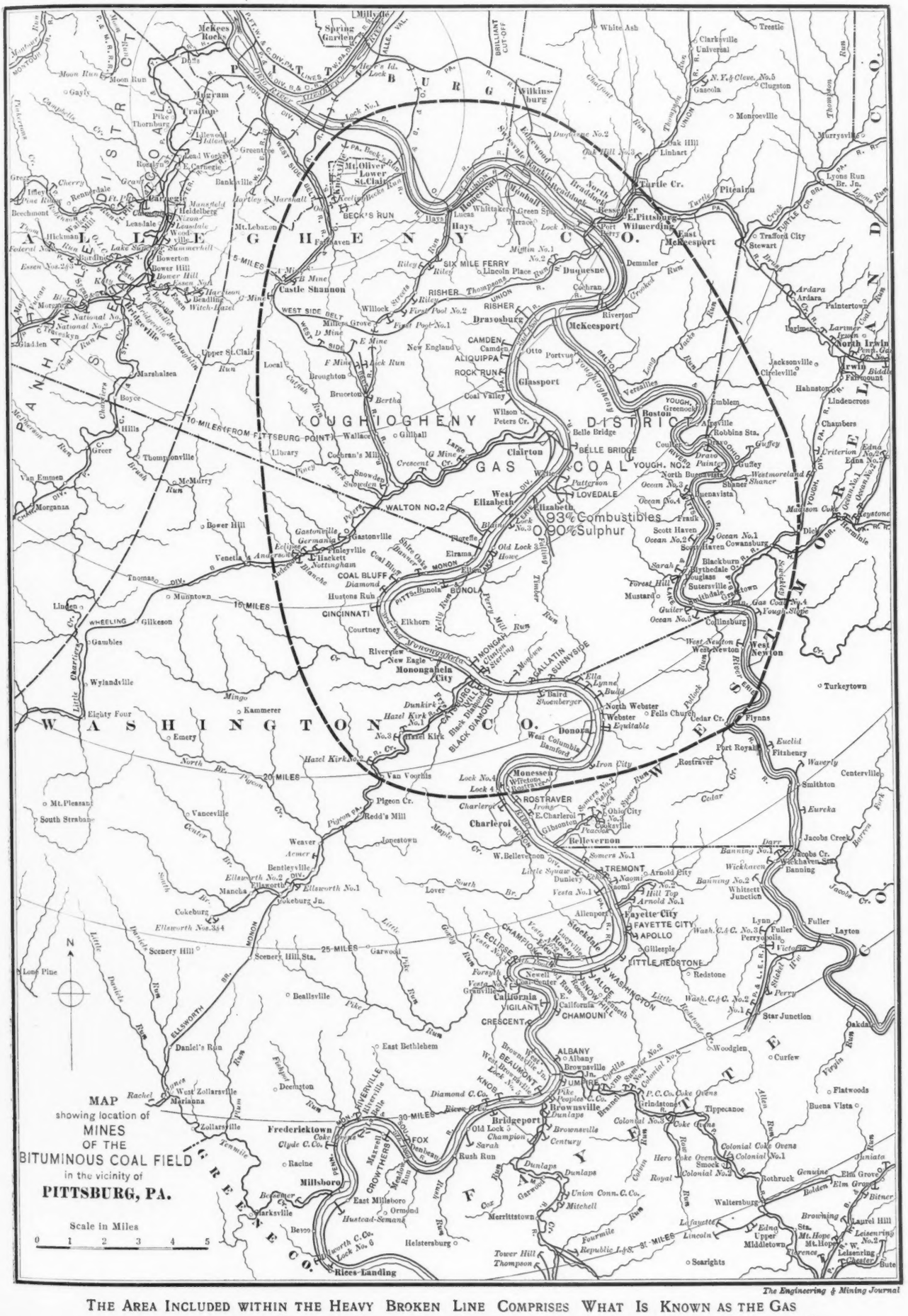


FOOT OF SLOPE SHOWING LOADS AT BOTTOM AND TRACK WHERE THE EMPTIES RUN TO THE PARTING

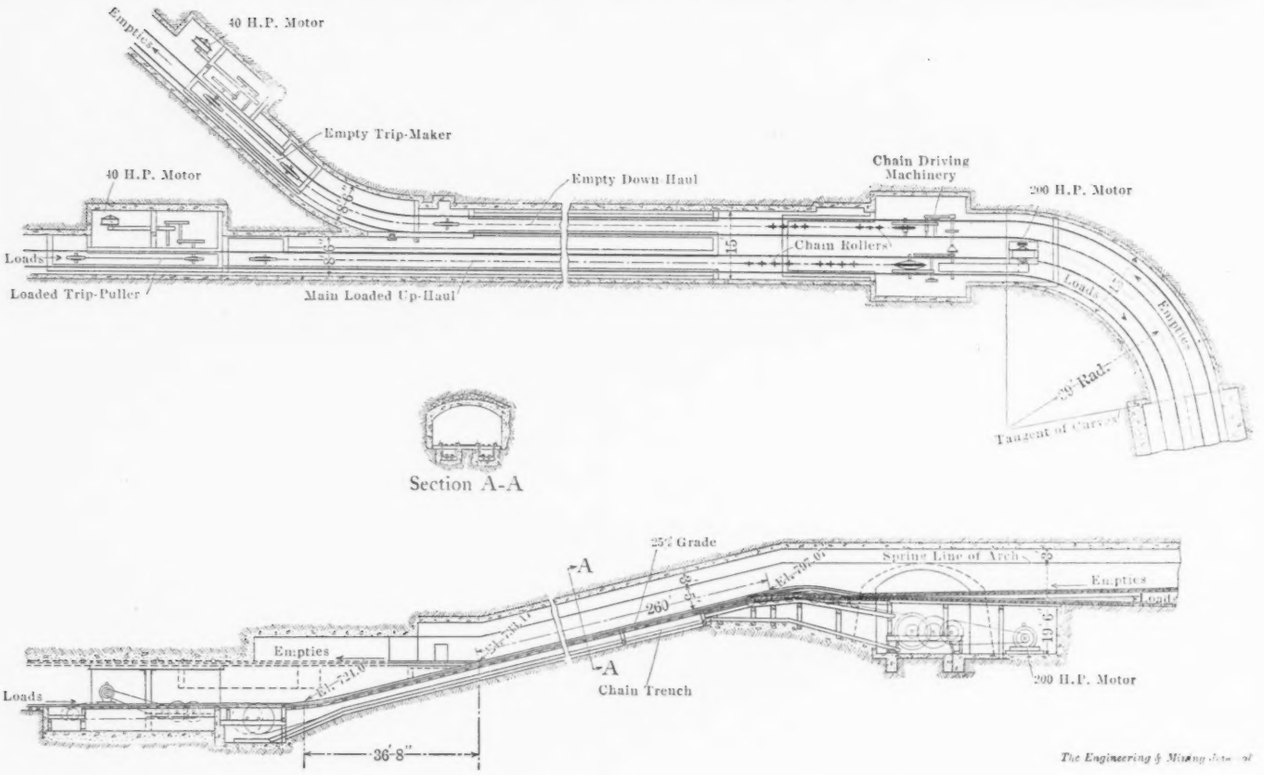
METHOD OF HANDLING THE COAL ON THE TIPPLE

After the loaded cars are elevated by the car-haul into the tipple, they are directed by a man who operates the switches and car-haul machinery from an overhead bridge to either one of the three dumps. The cars at the various dumps run into an automatic car-feed regulator which insures their stopping at a point back of the dump; the moving car actuates a pair of horns which are released by the dumper by means of a treadle. The car in the regulator stands on a grade of 6 per cent. which insures a quick start from a state of rest.

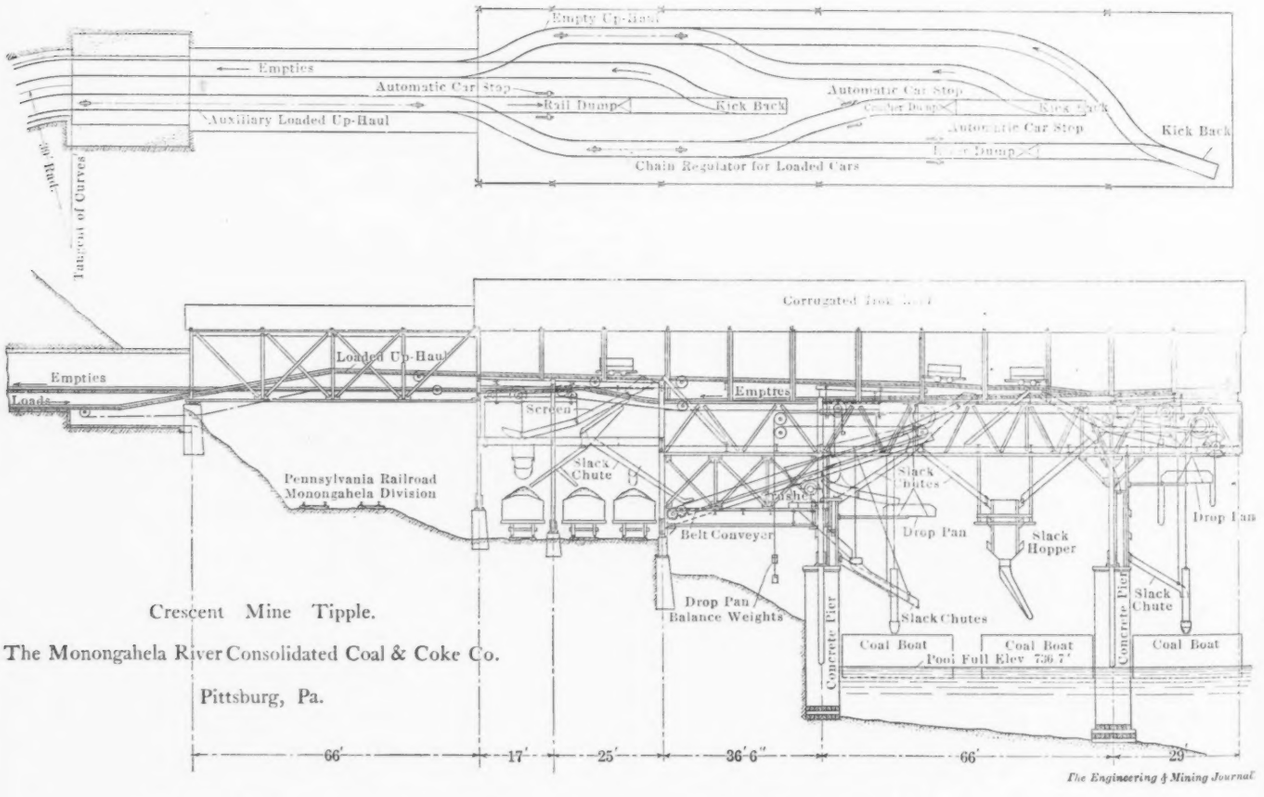
The dumps are all Phillips' cross-over dumps, three in number, a railroad dump, crusher dump and river dump. But lump and slack can be loaded on the railroad, and if necessary, nut and slack may be transferred to the river by the aid of the



THE AREA INCLUDED WITHIN THE HEAVY BROKEN LINE COMPRISES WHAT IS KNOWN AS THE GAS COAL DISTRICT. TO THE LEFT ARE THE STEAM COAL MINES



PLAN AND ELEVATION SHOWING ARRANGEMENT OF HOISTING SLOPE



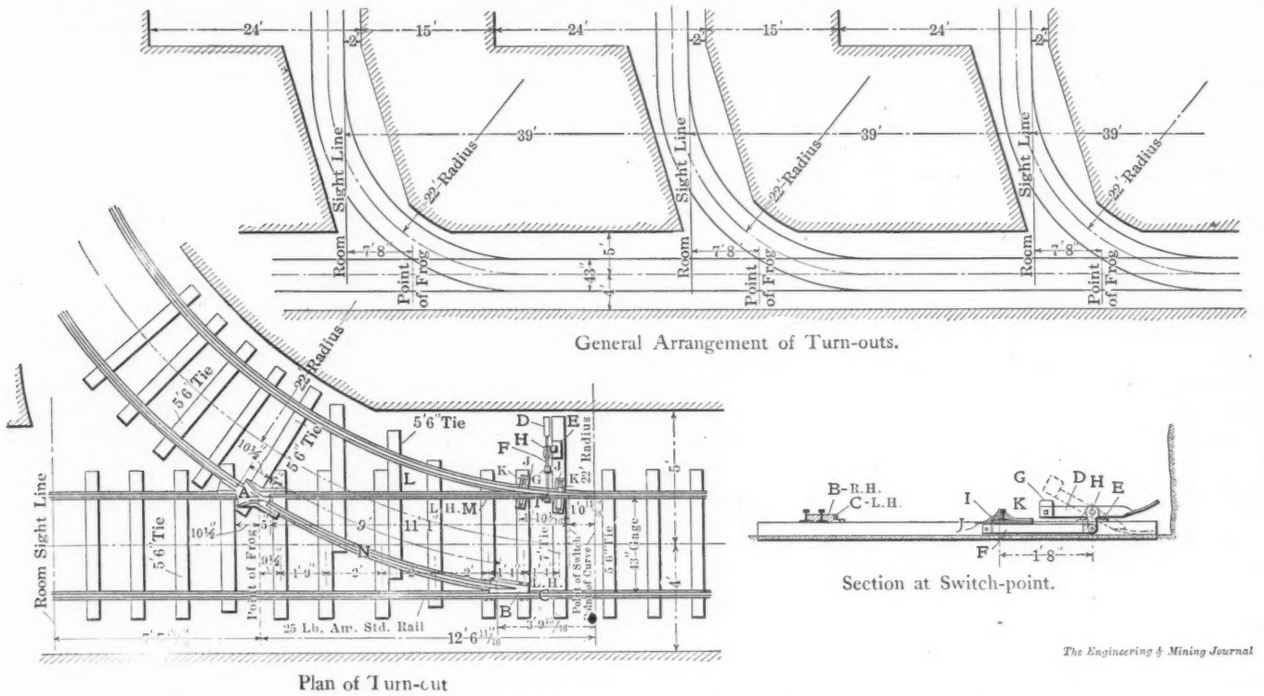
Crescent Mine Tipple.

The Monongahela River Consolidated Coal & Coke Co.

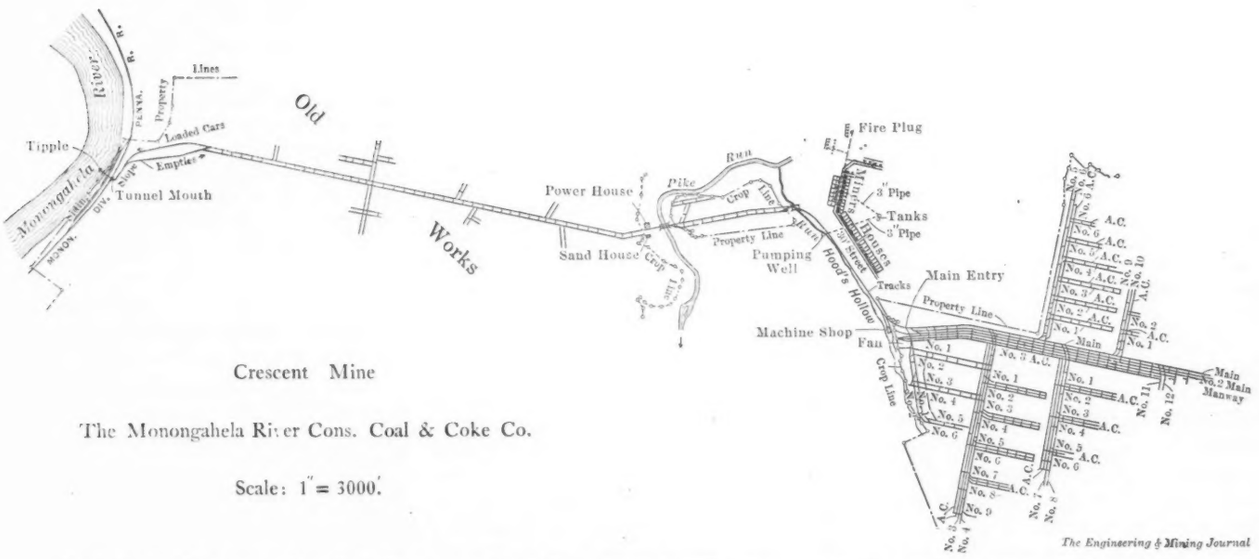
Pittsburg, Pa.

NOTICE THAT THE KICK BACK AT THE OUTER END OF TIPPLE IS TURNED SLIGHTLY TO RIGHT. THIS SCHEME HAS BEEN VERY SUCCESSFUL

belt conveyer which deposits it in a slack hopper over the river craft. The crusher dump will deliver lump coal to the crusher or to a drop pan which will deposit it in a boat. The slack from this dump on the river is either loaded into coal boats which are 176x26 ft. by 10 ft. deep or into barges and flats. In loading it is necessary to move the boats up and down the river so that the loading is done plan of operation. The entire plant has been completed at a considerable expense, and is probably the most modern of river coal-mine installations. The scheme of underground development is similar to the



GENERAL PLAN SHOWING METHOD OF CONSTRUCTING ROOM TURN-OUTS AT THE CRESCENT MINE



THE NEW WORKINGS ARE FAR BACK FROM THE RIVER AND ARE REACHED BY AN ENTRY THROUGH THE OLD MINE

can either be run in the same boat with the crushed coal, or if lump coal is being loaded from this dump the slack is conveyed to the slack hopper by a convey chute.

The outside river dump will load either run-of-mine or inch and a quarter coal. It is hardly probable that the three dumps will be used at the same time, but any two dumps will give a capacity of 6000 tons per day of 8 hours. The coal loaded in streaks, that is, from end to end of the boat. This moving is taken care of by a 6-drum Lidgerwood hoist, driven by a 25-h.p. Crane motor, by which one, two or three boats can be moved in the same or opposite directions at the same time. The capacity of a coal boat is about 1000 tons.

The accompanying illustrations were made especially to supplement this description, and show in detail the general methods used generally in mining the Pittsburg seam, and will be described in a later article.

I am indebted to C. F. Osler, chief engineer of the Monongahela River Consolidated Coal and Coke Company, Pittsburg, for all of the drawings and much descriptive information; also to L. J. Robb, chief engineer of the Heyl-Patterson Company, of Pittsburg, for data concerning the car-haul.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

S. W. Mudd, of Los Angeles, Cal., is in New York.

Charles Butters is inspecting the Porcupine gold area in Ontario.

Edwin E. Chase, of Denver, Colo., is in Arizona on professional work.

Robert Hay Anderson has removed his office to Centro Mercantil No. 31 in the City of Mexico.

John B. Keating, manager of the Bully Hill smelting works, was in New York last week, but has returned to California.

Horace F. Evans has established headquarters at Portland, Oregon. He is making examinations of mines in the southern part of that State.

Charles L. Doyle has been chosen president of the Pickands Magee Coke Company, Pittsburg, in place of the late William C. Magee.

Victor M. Braschi and Juan Cuyas, of Mexico City, are in New York attending a meeting of the managers of the Ingersoll-Rand Drill Company.

Edward Ryan, of Goldfield, has been appointed State mine inspector of Nevada, in place of E. E. Stuart, who has resigned and will go to Mexico.

F. A. Halsey, editor of the *American Machinist*, sailed last week for a cruise to the Mediterranean and Orient, to be followed by a trip through Europe.

E. S. Berry, formerly on the staff of Pope Yeatman, but more recently with John Hays Hammond, has returned to his former position with Mr. Yeatman.

G. H. Perkins, State geologist of Vermont, started Jan. 26 for a trip to Japan, India and other eastern countries. He expects to be absent until the last of July.

Carl F. Dietz, of Dietz & Keedy, Boston, has gone to Magdalena, New Mexico, on professional business in connection with some new complex ore-milling operations.

Frank A. Ross has returned to Spokane, Wash., after an extended trip to Mexico in the interest of the estate of Marcus Daly, which recently bought the Cinco Minas in Jalisco.

Irving H. Johnson, manager of La Eva Coneto Mining Company at Coneto, Durango, Mexico, has just recovered from an attack of typhoid fever, and will make a visit to the United States.

Joseph E. White has been appointed manager of the Quartette Mining Company at Searchlight, Nev., in place of George B. Wilson. Walter A. Hopkins has been appointed assistant manager.

W. Spencer Hutchinson, consulting engineer of the Vulture Mines Company, starts for Arizona this week to arrange for the installation at the mines of a cyanide plant on a plan designed by J. V. N. Dorr.

R. K. Stockwell, has resigned the position of smelter engineer with the Steptoe Valley Smelting and Mining Company and is now construction engineer for the United States Smelting, Refining and Mining Company, being for the present at Eureka, Utah.

Albert L. Waters, of Los Angeles, Cal., has finished his engagement to put into successful operation the new pyritic smeltery at Modern, six miles north of Denver. He has gone to Arizona on professional business and, after visiting Los Angeles, will return to Denver about the middle of February.

A. Kennedy Macfarlane, formerly connected with the San Francisco del Oro Mines, Ltd., of Parral, Mexico, has been elected general manager of the Manta Mining Company, Ltd., of London. This English company, closely allied with the San Francisco del Oro, is operating in the Santa Eulalia district, near Chihuahua.

Thomas R. Stevens, for some time with the milling department of the Guanajuato Development Company at Nayal, also with the Bustos mill, Pachuca and Amparo mine, Jalisco, Mexico, has left for the United States on his way to Russia, where he has accepted a position with the Caucasus Copper Company at Batum.

Obituary

Bernabé Gomez Iribarne, chief engineer of the first class of the Corps of Mining Engineers, and chief of the mining district of Almeria, died Dec. 24 at Almeria, Spain.

Fayette Brown died in Cleveland, O., Jan. 20, aged 86 years. He was born at Bloomfield, O., and went to Pittsburg when a young man. In 1851 he removed to Cleveland and engaged in business. After serving two years during the Civil War, he returned to Cleveland and became general agent and manager of the Jackson Iron Company, which owned iron mines at Negaunee, Mich. He retained his connection with that company until 1887. In 1880, with his two sons, Harvey H. and Alexander E. Brown, he organized the Brown Hoisting and Conveying Company, the name of which was later changed to the Brown Hoisting Machinery Company. To his energy and business ability and the inventive genius of his son, Alexander Brown, the success of this company is largely attributed. In 1883 he was appointed receiver of Brown, Bonnell & Co., of Youngstown, O., and was successful in settling the complicated affairs of that concern. At the time of his death he was president of the Brown Hoisting Machinery Company, chairman of the Stewart Iron Company, Ltd., operator of blast furnaces at Sharon, Penn., and coke ovens at Uniontown, Penn., and a member of the firm of H. H. Brown & Co., commission dealers in iron ore. He had also been prominently identified with other important manufacturing companies in Cleveland.

James McKee Kelley died at East Liverpool, O., aged 75 years. He was born near Bucyrus, Ohio, and was a graduate of Oberlin College. In 1857 Mr. Kelly went to Smiths Ferry, Penn., where he engaged in the oil industry. The oil was sent to Cleveland, where Mr. Hanna was located, and where a market was found for it. A company was formed by the two men, which later, it is said, formed the foundation for the Standard. Mr. Kelly was next associated with Colonel Bedard, of St. Louis, a widely-known oil operator. Following this Mr. Kelly formed a partnership with Joseph Hart, of Frederickstown, and drilled the first wells in Island Run, which attracted to the spot oil speculators from all parts of the country. Later he became associated with Gallagher Brothers, oil operators, whose interests were later absorbed by the Standard Oil Company. Mr. Kelly was one of the three men who conceived the idea of conveying oil to various parts of the country by pipe line, and laid the first pipe line for that purpose. Mr. Kelly was associated with Colonel H. R. Hill, of East Liverpool, the firm name being Hill & Kelly, and they established the first gas line in East Liverpool. Later this concern was taken over by the Bridgewater Gas Company. Until 1897, when he retired from the oil trade, Mr. Kelly represented the Standard company in the Smiths Ferry territory.

Societies and Technical Schools

Rocky Mountain Club—A dinner was given to the members of this New York club by W. B. Thompson, Jan. 29, at the Waldorf-Astoria, at which were present as guests or speakers many prominent mining men.

Canadian Mining Institute—The twelfth annual general meeting of the institute will be held in the city of Toronto, on Wednesday, Thursday and Friday, March 2, 3 and 4. The headquarters will be the King Edward Hotel, Toronto.

Mexican Institute of Mining and Metallurgy—The regular monthly meeting on Jan. 27 was held at the School of Engineers in the City of Mexico. The occasion was a special invitation from the director of the school to the members of the institute to visit and inspect the principal departments of the school.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

Jan. 27—According to Superintendent E. F. Sweeney, of the San Francisco mint, the gold production of California for 1909 was about $19,000,000. There are about 1100 producing metal mines in the State and about 400 of these are deep mines, the remainder being placers of various descriptions. The deep mines are now yielding about 2,500,000 tons of ore annually, of which 2,000,000 tons are of milling ore, with an average content of over $5 per ton. The larger part of the silver production of the State comes from the copper ores and their fluxes of Shasta county. The quartz mines yield more gold than the placers, but the quota from placer operations is increasing yearly, due largely to the dredges, which are estimated to have produced approximately $6,500,000 in 1909. Butte county is in the lead, with an output of over $3,000,000, while Yuba and Sacramento counties yield the larger part of the balance.

Were it not for dredges, the gold production would have gradually decreased during the last 10 years. There are now nearly 75 dredges operating in the State, mostly at Oroville, Marysville and Folsom. Dredges are also in operation in Siskiyou, Calaveras and other counties. The value of the gravel thus mined varies from 10 to 20c. per cu.yd.; and under favorable circumstances, with the largest dredges, the costs are as low as 2c. per cu.yd. The average cost is, of course, higher. Some of the larger dredges handle 250,000 cu.yd. per month. Nevada county continues to lead in gold-quartz mining, with a yield of over $2,000,000, largely contributed by the North Star and Empire mines at Grass Valley.

Shasta county is far in the lead in copper production, while a little known property, that of the Penn Chemical Company at Campo Seco, in Calaveras county, adds an important quota. The Campo Seco Mining and Development Company has recently been organized to open up some copper claims near those of the Penn Chemical Company and farther north in Amador county, 1000 acres of presumed copper land has been secured by the Henrietta Mining Company recently incorporated at San Jose, Cal. and for which E. J. Olsen is the managing engineer. The Champion group of mines at Nevada City is credited with a total production of about $25,000,000 in gold and silver. For the last year this property has been under consideration by eastern and London interests. A corporation, to be known as the Champion Gold Mines Company, has been formed by these interests with a capitalization of $5,000,000. This company on Nov. 20, 1909, made the first payment on the property. A new vein of high-grade milling rock has been uncovered recently in the Champion.

The sensational litigation between the owners of the Sixteen-to-one gold mine at Alleghany has been settled by compromise. A new company was formed to acquire the property, the various litigants receiving shares for their interests. The compromise of the law suit is fortunate as it allows of the reöpening of this valuable property at once.

The controversy between the Kennedy Extension Company and the Argonaut at Jackson is proceeding. Surveyors are now on the ground to make thorough surveys to decide if the Argonaut has abstracted ore from a vein apexing on the Kennedy Extension ground. The Kennedy Extension Company should not be confused with the Kennedy Mining and Milling Company owning the famous Kennedy mine, a little to the north. The Kennedy Extension Company took over the old Muldoon claim lying a little east of the Argonaut, and opened it up. Further trouble is in store for this company as one Phelps has filed on a strip of land 60x100 ft. on the south border of their property. When Phelps sent men to this strip of land to do work, they were driven off by the Kennedy Extension employees.

Denver

Jan. 29—In the case of the Government against Fay, Keitel, Rumsey, and six others, of St. Louis, for conspiracy to defraud the Government out of 5120 acres of anthracite land in Routt county, the jury, after an hour's deliberation, found them not guilty. This and the case against the Union Land Company were the Government's two star cases, and it has lost both within a month.

The Cripple Creek deep drainage tunnel is within a few feet of the 12,300-ft. mark, and now about 2250 ft. from the shaft of the El Paso mine. The tunnel is now under Beacon hill, and the first dike has been crossed. It was altered granite, slightly mineralized, and water is now coming in at this point, it is reported, at the rate of about 100 gal. per min. The lower workings of the El Paso mine will be the first to be drained by the tunnel, and large bodies of the extraordinarily rich ore for which this mine is famed will be then available. In this connection, it is stated that local financiers, who are large stockholders, will in March endeavor to wrest the presidency and management from Allen L. Burris, who represents eastern stockholders. The stock is about evenly held between the two factions, and the struggle will be a close one.

In the Ruby mine on Bull hill, a 2-in. streak of the abnormally rich stuff incidental to the Cripple Creek district has been struck. As usual, the reprehensible practice of publishing assays of specimens has been followed, in this case being given at 1003 oz. silver and 3100 oz. gold. It would be more to the purpose if we could chronicle the marketing of even one ton of such ore. This is worthy of notice, however, from the fact that it was struck at 1365 ft. below the surface, and in view of the drainage by the tunnel of the deepest workings of the district and the existence of rich ore at those depths.

In like manner comes a report from the same district of $1284 ore in the Trilby at a depth of 1200 ft., and, as usual, accompanied by the statement that "the extent of the body cannot be determined at this time, as no development has been done." What happens is this: directly a shot exposes some rich stuff, the owner or lessee rushes off to the assay office with a few pieces of it, and then gives the newspapers the assay. Whereas if he would wait until be could give the return of a shipment, or even of a quartered-down average sample, of say a ton only of the ore, it would be much more satisfactory and less deceptive.

Butte

Jan. 29—A number of property owners along the line of the proposed tramway from the Davis-Daly Company's Colorado shaft to the Great Northern tracks have begun action to enjoin the city council from granting the right to the mining company. The ground on which they base their protest is that the council, in doing the act complained of, would be granting a franchise which they have no right to do without first submitting the matter to the taxpayers. The city attorney has recently submitted his opinion to the council stating that they had this power, but the matter will now be fought out in the courts and should be definitely determined within a short time after the hearing on the order to show cause which will be had next week. In

the meantime, the mining company is not shipping any ore.

The Bank of Fergus County recently secured a judgment against the North Moccasin Gold Mining Company for $120,000. The action was brought on behalf of the bondholders and went by default. A serious cave some time ago resulted in a cessation of operations and nothing was done since so the company was unable to meet the interest on the bonds.

A holder of a considerable amount of stock in the North Butte Mining Company has received a letter from the secretary at Duluth in answer to inquiries as to the condition of the property which says:

"We have your letters making inquiry relative to the present condition of this company, on account of the decline of its stock upon the stock market. The rumors which you have heard relative to the mines are very much exaggerated. While it is true that on the 2000 and 2200 levels of the two principal veins of our mines the very rich ore values such as encountered on the 1600 and 1800 levels were not developed, commercial ore of a good grade was shown and large stopes opened up, which insures the continuance of the mines. The cost of manufacturing copper from this lower grade ore is increased. This increased cost of production, together with the low price and unsettled condition of the copper metal during the past year, necessarily has reduced the earning capacity, and probably will cause a reduction in the dividend rate, unless the price of copper advances. The latest advices from the mines show that a much better grade of ore is now being found. The company has maintained a good production and at a profit. It has carried on development work well ahead of extraction. At present it has one operating shaft, and work is now under way toward sinking of a second shaft. There is under consideration a new smelting contract which will be upon much more favorable terms than the one now in existence. The cash surplus of the company is not large at present; it never has been the policy of the management to accumulate a large surplus, but to distribute it to the stockholders as earned. There are no debts except for current operations, which are taken care of promptly each month. We trust this information will satisfy and reassure you that the North Butte mines are not as represented by the rumors now afloat."

Salt Lake City

Jan. 27—The annual meeting of the Salt Lake Stock and Mining exchange was held Jan. 22. Two new members were elected to membership in the governing committee, namely, F. C. Dern, and R. J. Evans. The other members of the board are James A. Pollock, W. J. Browning, W. H. Child, W. Nebecker, R. S. Wimmer, James L. Hamilton, and W. H. Tibbals. The board has not elected its officers yet, though it is not conceded probable there will be any important changes from the present. James A. Pollock to remain as president, James A. Shorten, secretary, and W. A. Wasson, caller. Secretary Shorten submitted the annual report, dated Jan. 1, 1910, which showed that the last year had been a successful and prosperous one. The exchange has grown steadily within the last few years from almost nothing to the present substantial organization.

Upon retiring from the active management of the Boston Consolidated Mining Company, Lafayette Hanchett was presented with a silver service of six pieces by the employees of the company's mine, mill and office. Mr. Hanchett has been general manager of the Boston Consolidated for six years. The silver is engraved with the Hanchett monogram, and on the reverse side of the tray is the inscription, "Presented to Lafayette Hanchett, general manager of the Boston Consolidated Mining Company, July 1, 1904, Feb. 1, 1910, by the employees of the mine, mill and office. 'A friend is worth all the hazards we can run.'" Mr. Hanchett has left for a tour of the world and expects to be absent about a year. Until the details of the Utah Copper-Boston Consolidated merger are finally adjusted, Louis S. Cates will act as general manager.

Work is progressing on the new smelting plant of the International Smelting and Refining Company. The new plant is at the foot of the Oquirrh range, 4½ miles from Tooele and about 6½ from the San Pedro, Los Angeles & Salt Lake railroad with which it is connected by the Tooele Valley railroad. The aërial tramway about 4½ miles long, connecting the Utah Consolidated company's properties at Bingham with the smeltery is nearing completion. The plant will cover an area of 60 acres. Some delays have been caused by the severe winter weather and the late arrival of structural steel. The first corps of engineers connected with the building of the new plant arrived in Tooele on Dec. 8, 1908, and began work on the survey for the Tooele Valley railroad which was completed in the latter part of May. Following the opening of this line, actual work on the smeltery construction was started. Since that time operations have been carried on on a large scale, and the construction forces have made good progress. Work on some of the buildings has been affected by lack of steel.

Indianapolis

Jan. 31—The Mine Workers of America are having the most turbulent convention in the history of the association. Efforts have been made on one or two occasions to break up the convention and so persistent have been the enemies of President Lewis that offending delegates were removed from the convention hall.

Plans have been perfected for the confederation of the Mine Workers of America and the Western Federation of Mines. The keynote of the speeches made during the week was the necessity of standing together in the demand of the bituminous miners for an increase in wages of 10 per cent. or more; that no one district organization shall sign the uniform wage contract till all districts shall sign and if a strike is inevitable in one or more districts, all shall strike. The delegates were not satisfied with urging immediate action, following April 1, among the mine workers alone. They insist that between now and that time all organizations should be asked to cooperate; that the railroad organizations should be asked to refuse to haul nonunion laborers or nonunion coal; that the steel workers coöperate in a similar manner, all of the organizations uniting in a general struggle for better conditions. President Lewis and other conservative delegates urged that the organization proceed cautiously. They said the best plan was to continue work after April 1 at the present scale until an agreement is signed covering all the districts. This suggestion aroused some of the radical delegates, who charged Mr. Lewis with having previously played into the hands of the operators and said that he was preparing to do so again.

It is not unlikely that the delegates will go to Toledo in a body to attend the wage conference. It is known that the operators will oppose an increase in the scale and the delegates do not seem willing to trust the strength of the scale committee to cope with the operators in the conference which begins Feb. 2.

The miners went on record as opposed to the use of electricity in coal mines. They declared that the leakage on account of poor insulation caused the sparks to ignite the gas in mines and occasion explosions. They also claimed that the use of electricity was hazardous because of the kind of explosives they are now required to use for blasting purposes.

Cobalt

Jan. 28—The financial statements of the two big Cobalt mines, the La Rose and the Nipissing, show a big difference. The La Rose statement shows cash in the bank, ore in transit and at the smelteries and ore at the mine ready for shipment, to the value of $382,638, while for the Nipissing it is almost $1,000,000 in excess of this, amounting to $1,322,985. The latter company has been showing a steady improvement the last year, and the surplus for that period is about $400,000.

The O'Brien option on the Miller and Gillies claims in the Porcupine district has been abandoned and the diamond

drill is being taken out. It is stated that a hitch occurred in getting the option extended and as several other people were after the property, the owners would not extend the option without a large part of the initial payment of $50,000 being paid. It is understood that an option has been given to other people for a larger sum than M. J. O'Brien was to have paid.

At the annual meeting of the Crown Reserve in Montreal, Jan. 26, President Carson announced that the regular dividend of 24 per cent. and bonus of 36 per cent. would be paid during 1910. The surplus at the end of the year amounted to $549,275, while dividends to the amount of $1,238,169 had been paid. The profits on operating amounted to $1,436,398.

At the annual meeting of the Hargrave company the directors were authorized to issue treasury stock to the amount of $1,400,000 for development purposes as might be deemed advisable. President W. N. Ferguson stated that ore was being sacked from two shafts. Manager Neelands reported that good silver contents were found in drifting north from the shaft on No. 1 vein, and that on No. 3 the vein varying from 1 to 6 in. assayed 3000 oz. The financial statement showed a credit balance of $31,273.

Toronto

Jan. 27—The first meeting of the Canadian Commission for the Conservation of Natural Resources, took place at Ottawa. Hon. Clifford Sifton, chairman, in his inaugural address reviewed the circumstances which led to the organization of the commission. He noted that the first great work should be the making of a complete inventory of resources, and pointed out that in spite of the increase of the mineral production of Canada during recent years this development, exclusive of the Yukon, had taken place only in the settled portions of the country, while by far the greater portion of the Dominion remained unprospected. Great bodies of minerals known to exist were at present useless because of the lack of effective measures of treatment. Electric smelting processes promised an enormous development for the iron-ore deposits of Ontario. At Cobalt wasteful methods of mining prevailed, and in British Columbia there was failure to save valuable mineral contents such as zinc, in the treatment of copper ores. The fatality record in mining accidents was one of the worst in the world, and there was urgent need of effort to protect the mining population. The water powers of Canada were roughly estimated as capable of a possible development of nearly 17,000,000 h.p., while the present development was only about 511,000 horsepower.

The remainder of the day was devoted to a reception of the commission by Earl Grey and Sir Wilfrid Laurier, and visits to some of the lumber mills.

Addresses were given by Dr. B. E. Fernow, dean of the faculty of forestry in Toronto University on "Forestry;" Dr. J. W. Robertson on the "Conservation of Agricultural Resources," and Hon. Adam Bock on the Ontario hydroelectric power scheme, which he stated would ultimately extend over the whole of southwest Ontario from Kingston to Georgian bay, while the northeastern portion of the province from North bay to the St. Lawrence would be covered by a similar system.

Dr. Eugene Haanel, director of mines, gave an address on "Possible Economies in the Production of Minerals in Canada." The foremost of these was electric smelting for the utilization of low-grade iron ores. The economical treatment of zinc products was urged. Another important saving could be effected by the development of the 36,000 sq.m. of peat possessed by Canada. Peat mull, a fibrous by-product of the peat manufacture, could then be had in quantities large enough to be profitable in export fruit packing. More enlightened methods in the mining of coal were also recommended, the present system being criminally wasteful. Doctor Haanel gave figures to show the appalling frequency of mining accidents, and urged the safe guarding of Canadian miners. The process of nickel mining was extremely wasteful, and all Canada got out of the nickel mines was the employment of an inconsiderable number of men, as compared with the advantage which would be obtained by exporting the finished product. A more rational treatment of Cobalt ores was necessary in order to reduce waste. Perhaps the best solution of the problem would be the establishment of well-equipped government laboratories for research.

Committees were appointed for the different branches of the work, the committee on minerals being as follows: Dr. H. S. Beland, chairman; Prof. Howard Murray, Halifax, N. S.; Hon. William Templeman, Canadian Minister of Mines; John Hendry, Vancouver, B. C., and the ex-officio members of the commission representing the various provinces.

The committee on minerals presented a report recommending the compilation of statistics; that mining companies be required to furnish an annual report of their output, and that the manufacture and use of explosives should be carefully regulated.

Cananea, Sonora, Mexico

Jan. 29—Approximately $400,000 has been spent by the Greene-Cananea company during the last year for new equipment, betterments and extraordinary repair work. All of this has been charged to operating costs currently, and the year's profit is lessened accordingly. The principal innovations added in 1909 are noted below. At the mines there was a greater amount of prospecting than in any previous year and a signal advance in tunnel work throughout. New ore bins have been put in at the Henrietta mine, near the Pavo Real adit, and the capacity of the Kirk bins was doubled. Steam pumps, with a few exceptions, have been supplanted by electric, as have nearly all the hoists; a 11,000-volt electric line was completed to the Henrietta, a distance of nine miles from the main plant, late in December. The Sierra de Cobre has been opened at three separate points; the arrangements for unwatering the lower levels of the Capote were made, and a pump set up on the 400-ft. level; and the Cobre No. 2, a part of the old Cobre Grande, was put on the producing list as a part of the Kirk mine.

An automatic sampler at the crusher bins, two large pumps in concentrating mill No. 2 for recirculation, a cooling tower for the same mill, a precipitating plant, two additional units of 40 vanners each and an impounding dam were the main improvements at this department. The new vanners are for treating tailings only; and, basing their totals from a normal ratio of concentration, the added capacities make the plant's entire tonnage range near 95,000 metric tons monthly. Mill No. 2 was shut down on Jan. 1 for rearrangement and repairs.

A new crusher at the end of the initial conveyer, an automatic sampler in the sampling mill, and a raising of the conveyer from the sampling mill to the spreading beds in order to obtain a horizontal position, are the main changes in the smelting plant. Additions to the reverberatory-furnace equipment are under advisement.

A marked lessening in power costs has been effected through the two large additions made in the power plant. The 6000-cu.ft. compressor was installed for the benefit of the mines, and the Veta takes practically all its supply. While all electrical-employing points were strengthened by the new 1500-kw. generator, its main purposes are to answer the needs of the mining end. A duplication of each of these units may take place during the present year. A renewal of all transformer stations has been an expensive item connected with the entire rearrangement of electrical power. The advantages of the new rate secured from the Southern Pacific railway will be a noticeable item in the final costs of copper from now on. Dr. L. D. Ricketts is in Cananea for an extended stay and is looking into several details with a view of further cost retrenchment. W. D. Thornton, president of the company, is also on the ground.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alaska

Knights Island—S. A. Hemple, manager of this copper company, reports property in a flourishing condition. Development work has been planned for the coming season.

Bonanza—Freight is en route to the copper property in the Copper river valley. R. F. McClellan is superintendent. Ore bunkers will be built.

California-Alaska—The company, operating a quartz property on Falls creek, has been reorganized and will begin development work early in the spring. John Kapsilmanis, is now the controlling factor in the company.

Gold Bullion—This company, operating in the Willow Creek region, Knik, has purchased an aërial tram to transport the ore from the portal of the tunnel to the valley below, where a mill is placed. The ore treated by the mill last season averaged over $100 per ton. F. McCoy, of Seattle, is manager.

Ellamar—This copper mine has resumed shipments of ore to Tacoma, the last steamer taking 650 tons.

Arizona

Cochise County

Calumet & Arizona—Gordon R. Campbell, secretary, says: "The company has over $3,500,000 of surplus funds. It has spent $1,000,000 in the development of outside properties that have been considered valuable and worthy of such development. Development of rich sulphide ores in the lower levels of Oliver shaft gives reasonable basis for the hope that similar ores also will be found at greater depth in the Irish Mag shaft. We are finding good ore now 1000 ft. deeper than it was believed to have existed 10 years ago. The physical and financial conditions of the company are better today and its prospects for the future are brighter than at any time in the past five years. The company will continue to earn and to pay dividends to its stockholders for many years."

Graham County

The Supreme Court of Arizona refused to grant the Arizona Copper company, of Clifton, a rehearing in the tailings case, and confirmed the injunction that compels the copper company to keep all slimes, tailings and débris from the works out of the river. The company gave notice of appeal to the Supreme Court of the United States.

Maricopa County

Vulture—Sixty to seventy men have been kept steadily at work and more than $150,000 has been expended during 1909. The new work by the Vulture Mines Company amounts to 3085 ft., consisting of crosscuts, drifts and raises, practically all of which has been on the Nos. 4, 5 and 6 levels, and in virgin ground below the old workings. The work of timbering the east incline has progressed satisfactorily. It has now reached 275 ft. and will soon be completed, after which this shaft will be sunk. The ore blocked continues to increase as the work progresses and the values are fully maintained, particularly on the No. 6 level, where another rich oreshoot was encountered. The mill has run steadily, meeting operating expenses. The monthly average value is from $8.50 to $11.50 per ton. The production of bullion is $31,393. The production will soon be increased by the completion of the new mill, which will have four times greater capacity. Construction work is progressing rapidly on the new mill. The contract requires its completion before April. The specifications call for stamps weighing 1600 lb. W. Spencer Hutchinson is consulting engineer.

Pima County

Twin Buttes—At the annual meeting, Michael Earles was elected president of the mining company and David S. Rose president of the Twin Buttes railroad. A sale of 18 m. of the railroad to the Southern Pacific was authorized. The capital stock was reduced to $2,000,000.

Yuma County

Little Butte—The shaft of the Little Butte near Bouse has reached 480 ft. R. P. Sharpe is manager.

Blue Slate—This group near Little Butte has a blue-slate formation with iron stringers carrying gold and copper. Two car loads shipped to El Paso gave a return of 18 per cent. copper. Thomas Bouse is one of the owners.

Continental—This company, owning 12 claims three miles west of Planet, has let a contract to run a 150-ft. tunnel with T. J. Hardwick in charge.

California

Amador County

Henrietta Mining Company—This company has been formed at San Jose, to work a copper mine. James Beatty, of San Jose, is president.

Dane-Mitchell Mining Company—This new corporation will work a mine at Pine Grove.

Butte County

Bucket Gravel Company—The "dry land" dredge of this company has commenced operations near Oroville. Water is used only for washing.

Crystal Peak—This company has been organized to operate the Crystal Peak mine near Enterprise.

Bumble Bee—At this mine, Morris ravine, F. W. Kuster superintendent, a chilean mill and concentrators have been installed, and from 12 to 18 tons of ore daily are being milled.

Chico—This company at Chico has 1012 acres of dredging land from 10 to 60 feet deep on the Dan Struter ranch and a dredge will be built. Frank Gilmore, of Red Bluff, is the president.

Mammoth Channel—This company has decided to carry on its prospecting operations for gravel with diamond drills.

Cherokee—The dredge owned by this company has quit work, the ground owned at Oroville having been worked out.

Calaveras County

Union—This mine at Stockton Hill is being reopened by James Maguire and John Varain, of San Andreas.

Utica—Forty of the 100 stamps of the Stickle mill of this company have been temporarily hung up.

Standard Amalgamated Exploration Company—This company, Oliver Reece, manager, has the Economic mine in San Antone district, 11 miles northeast of Angels, and is working also the Cuneo, Kate and Jane claims.

Boston—This mine in Mokelumne River district, three miles from San Andreas and long idle, will be started.

Eldorado County

Cedar Creek—This mine at Indian Diggings is now being worked by Sacramento men who are taking out coarse placer gold.

Green Valley—L. J. Strait, owner of this mine at Green Valley, has applied to the California Débris Commission for a permit to work the property by hydraulic process. The tailings drain into Alleghany creek.

Mount Pleasant—From this property at Grizzly flat a $6000 gold brick was the cleanup for December.

Golden Cup—Arrangements are being

made to resume work on this mine at Spanish Dry Diggings.

Pyramid—This mine at Shingle has started operations.

INYO COUNTY

In the Queen Ann, an 8-ft. vein has been found on the 300 level. A small vein has been found in the Meacham & Keys, assaying $60 per ton. On the City the 5-stamp mill will soon begin crushing. The Columbia company is laying a new water-pipe line seven miles long. A reduction plant is on the way.

Graham & Jones—A shipment of machinery for the mine in the Argus range has been received at Searles. This mine was located about one year ago, the discovery encouraging many prospectors to go into that section. A 10-stamp mill will shortly be erected.

New Coso—This company near Darwin, C. T. Fitzhugh manager, is producing from the Lucky Jim. A 70-h.p. gasolene hoist is being installed.

Four Metals—This company is finding new orebodies in the Union mine, Cerro Gordo. Galena is being taken from the 1035 level.

Skidoo—Further details have been learned of the strike at the mine. The ore is now known to be of a better grade than was at first reported, and developments along the vein point favorably to an added production. Fifteen stamps are dropping. E. A. Montgomery, principal owner, is at the mine.

Buckeye—This company, near Fish Springs, L. C. Davis manager, has a large amount of machinery on the way for an electric development and reduction plant. Steam shovels will be installed. When the mill is up a cyanide plant will be put in.

MARIPOSA COUNTY

Greens Gulch—This mine near Mt. Bullion has been closed owing to a disagreement about wages of miners.

Ruth Pierce—The difficulties of this company near Hornitos have been settled and work will be resumed.

Number Nine—A vertical shaft will be sunk to the 800 level and the old incline shaft given up at this mine near Hornitos, Richard O'Brien, manager.

NEVADA COUNTY

Lily—A. H. Hoge, of Cleveland, Ohio, has bonded this group, east of Grass Valley, and will sink a 300-ft. shaft. C. H. Mallon is president.

Champion—This Nevada City property is now under the management of T. A. Kelley, representing the Champion Mines Company.

PLACER COUNTY

Crater—The 10-stamp mill and equipment on this mine near Ophir has been completed. The mine is owned by W. P. Hammon, of San Francisco, and 40 men are at work.

Colorado

LAKE COUNTY—LEADVILLE

A number of lessees are at work on Rock and Iron hills, and at the Dome, Stone and La Plata mines 20 tons per diem are being shipped from each. It is stated that the ore contains enough lead carbonates to enable them to have the ore smelted free of charge. The ore is hauled to the Yak switch.

Ella Beeler—Lessees on the above mine are shipping $10 ore to the smeltery, and the orebody is widening.

Houston—This mine, above the Ella Beeler, is sinking a winze from the tunnel on a 6-in. streak of ore.

Sunday—In a crosscut from a 100-ft. lift sunk 100 ft. below the tunnel level, it is stated that an 8-ft. vein has been intersected, which has 3 ft. of solid ore.

Yak Tunnel—It will be some months yet before the company will be able to lease the ground of the Resurrection No. 1 and 2, and the Sedalia or Silent Friend, but the water is said to be running two feet deep on the floor of the tunnel, and these properties are being rapidly drained. The monthly output from the tunnel is about 7000 tons of ore.

Garbutt—The lessees on this Breece hill mine are outputting 75 tons of good-grade ore daily.

Morning Star Consolidated—The lessees on this company's mines are shipping ore daily.

Gold Basin—The lessees are shipping seven carloads of ore per month.

ROUTT COUNTY

There are now three shipping mines on the Moffat road from the Oak Creek section of the Yampa coalfield the Prentice mine from a 14-ft. seam of clear coal which retails in Denver for $5.25 per ton as against $4.25 for northern coalfield lignites; the Oak Hills mines, S. M. Perry, manager; and the Juniper mines, Mr. Craise, manager. The latter is now in course of being equipped with adequate machinery, tipple, etc. The Oak Hills company is equipped with one of the finest and most modern plants in the West at a cost of $500,000 and heavy shipments are being made.

SAN JUAN REGION

Silverton has been suffering greatly from snow blockades and want of coal, and the output of ore has been largely curtailed, and will continue to be until spring opens the trails. The December shipments were 4800 tons.

Camp Bird—This mine in December crushed in 29 days 6791 tons yielding 6487 oz. of bullion and 784 tons of concentrates. The profit for the month was about $100,000.

TELLER COUNTY—CRIPPLE CREEK

Findley—At the 11th level Frank Clay, lessee, has a shoot of ore, of which the screenings will give 2 oz. gold per ton, and the coarse rock one ounce.

Modoc—In the Ocean Wave claim on the saddle between Bull hill and Battle mountain, a crosscut at the 11th level has opened a parallel vein to the main Modoc lode, and in an upraise it is reported that the vein has attained a width of 8 ft. At the 9th level of the main Modoc vein, the lessees are shipping high-grade screenings and ore.

Doctor-Jack Pot—This mine, worked by the General Leasing Company, is again to the fore with a strike of 3 ft. of ore running for 2 to 5 oz. gold per ton. Sherman Bell, manager.

Mollie Kathleen—This mine, which adjoins the Hoosier and Friday, just north of the Gold King on Tenderfoot hill, has sent out two carloads recently.

Trail—The Trail and Blue Bird, adjoining properties but different owners, are under lease to the Humphreys-Thompson Leasing Company. By agreement with the latter mine, which has one of the deepest shafts in the district (over 1300 ft.), a drift on the 800 level was run into the Trail vein, exposing over 8 ft. of payable mill ore.

Strong—Persistent statements come from Cripple Creek that sealed box cars containing ore admitted to yield 10 to 15 oz. gold to the ton, are being sent from the mine. The company is controlled by Lennox & Giddings, of Colorado Springs, who never give out any statements as to what the mine is doing.

Jolly Tar—This mine, which adjoins the Strong, Victor, is shipping again, and has sent out a car of ounce ore from the 100-ft. level. This mine, like the Gold Coin, is in the granite, just outside the breccia area.

Stratton's Estate—Lessees on the Six Points mine on Bull hill have broken into a 2-ft. vein of ore that runs 2 oz. gold per ton. Block 239 of Stratton's Estate has ore that is returning 4 and 5 oz. gold per ton. It adjoins the American Eagle, which is also shipping 2- to 4-oz. ore.

Lucky Corner—This and the Little Clara and Callie mines, operated through the Ophelia, formerly known as the Moffat tunnel leased by the Humphreys-Thompson company, are shipping 10 carloads per week.

Abe Lincoln—This property under lease to John Sharpe has 3 ft. of ore and is outputting about three carloads per week.

Jerry Johnson—Lessee Edwin Gaylord, on the Damon claim of the company, is breaking ore 14 ft. wide, with bulk values of $28 per ton in gold, and this large orebody has been worked for nearly a year, with no decrease in size and values. Present output, two cars per diem.

Savage—The Gold King mine, on Gold hill, owned by the company, is shipping

from the recent strike, and the ore averages $25 per ton, and contains sylvanite and free gold. Edward Kimsey is the manager.

Elkton—From the Gregory mine, on Raven hill, steady shipments are being made from a vein 4 ft. wide, said to run from $14 to $33 per ton from wall to wall.

Idaho

Coeur d' Alene District

Vendetta—A crosscut has opened a vein 15 ft. wide carrying lead and silver.

Coeur d'Alene-Vulcan—The lower tunnel has gone 1150 ft. with 1850 ft. to go to get the big shoot uncovered above. Four veins will be cut by the tunnel.

Advance—The company has settled its difficulties and work will resume April 1 on this property near Sandstorm.

Big Elk—The lower crosscut has tapped lode and the drift will be run 1800 ft. to get under shaft at depth of 900 ft. Copper ore taken from shaft and sacked.

Nabob—The long lower tunnel is being driven in 250 ft. with 1700 ft. to go. Work was recently resumed after a long shutdown.

Oreano—The face of the drift is filled with iron carbonates at 600 feet.

Coal Creek—The drift has exposed chalcopyrite for 100 ft. and crosscut from face of drift has gone 20 ft. in high-grade ore.

Monarch—This mine is shipping several carloads of lead-silver ore per month, taken out while driving the 860-ft. raise, which will be completed Feb. 1.

Sterling—Carbonate ore has been encountered by tunnel at 700 ft. The property has the Bunker Hill & Sullivan vein.

Pine Creek—Five feet of good galena and zinc ore has been opened.

Hercules—This company gives the mine employees a holiday every Sunday, a feature unusual in the district. Men must take out enough ore in six days, however, to run the mill seven days.

Indiana

Indiana furnished 54.51 per cent. of the limestone output of the country during the year 1908, and stonemen estimate that when the figures for 1909 are compiled the amount will be much larger. The total limestone output of the State in 1908 was valued at $3,487,039, an increase of $109,039 over 1907. Of this output about 80 per cent. was quarried in Lawrence county.

Pittsburg—Two hundred miners working in the mine near Sanford, demanded that an engineer be on duty at the mine while the shots are being fired. The men declare that under present arrangements they would have no means of escape in case of an accident during the hour which intervenes between the time the day engineer goes off duty and the night man comes on. The entries are now so long that the men cannot get their shots fired in time for the day engineer to hoist them to the surface.

Vandalia Coal Company—A. M. Ogle, president, announces that within a short time two new mines will be opened in the company's undeveloped property near West Terre Haute. The machinery for each mine will cost between $100,000 and $150,000, and 1000 employees will be necessary to operate the two. Drilling has disclosed satisfactory coal deposits in this territory. The new mines will have daily capacities of 2000 tons, and will be equipped with the best machinery and electric power. The company has at present 13 mines in operation.

Michigan

Copper

Mohawk—This mine has reached the hanging wall of the Kearsarge lode in the crosscut from the 1st level of No. 6 shaft and found it to be about 18 ft. wide and well charged with heavy copper. Drifting has been started in both directions and as soon as the shaft house is ready to handle rock, shipments to the mill will be made. Sinking will be resumed shortly.

Ojibway—This property has called an assessment of $2 per share—payable in March and October. This will afford funds to carry on the development. A compressor has been ordered and upon its going into service additional drills will be started. Drifts from the 500- and 650-ft. levels of both shafts are opening a good grade of stamp rock.

New Baltic—No. 3 drill hole has reached 140 ft. This drill is going down 1100 ft. north of No. 2 hole and will reach the lode at about 600 feet.

Oneca—The company has rigged up a drilling outfit 2000 ft. southwest of the No. 5 hole, from which a core was taken showing a mineralized amygdaloid formation. This new drill will cut this lode at 600 ft. The No. 5 hole continues sinking to expose the Oneca lode.

Allouez—In the sinking of the two shafts and the extension of the several drifts good ground continues to be opened. Production is being increased as the first head in the new addition to the stamp mill has gone into commission.

Montana

Butte District

The January output is estimated at 22,867,800 lb. An increase over December of nearly 6,000,000 lb. and an approximation of the normal output.

Butte & Superior—The first shipment of concentrates from the Butte zinc ore was recently made from the Basin concentrator, and consisted of two carloads of 40 tons each. The concentrates average 50 per cent. zinc, and are reduced about three into one. When the spur to the mine is completed, shipments from mine to concentrator will be increased to 400 tons daily.

Tuolumne—The company is running a raise from the 1200-ft. level to the surface to ascertain what rights it has to the part of the Jessie vein now in dispute with the North Butte company.

Jefferson County

Corbin-Copper—A 200-ton concentrator has been ordered and will be in operation by April 1. The water will be taken from Clancy creek.

Madison County

Pritchett—N. J. Beilenberg, W. I. Higgins and others have recently acquired from Steward & Steward the lease and bond held by them. They plan to drive a crosscut tunnel 100 ft. to intersect a lead parallel to that already drifted upon.

Green-Campbell—John Wiant and B. C. Leyson have secured a lease and bond for $185,000 on the property at Silver Star.

Apex—The tunnel is in 520 ft. and the shaft is down 300 ft. On the 240-ft. level the vein was crosscut 70 ft. from the shaft. About 15 tons of ore are being treated daily at the mill.

Nevada

Esmeralda County

Goldfield Consolidated—During December the total production of the company was 20,234 tons containing $741,668, or an average of $36.65 per ton, of which the whole was milled with an average extraction of 93.83 per cent. The net profit to the company was $495,353, or $24.48 per ton. The development work consisted of 4390 lineal feet. Manager J. R. Finlay does not report on developments and mine conditions owing to his unfamiliarity therewith and the fact that Mr. Mackenzie and Mr. Henderson are both absent. He states, however, that the development work accomplished was undoubtedly successful to the usual extent and the amount of work done was unusually large. The mill has been demonstrated to have a daily capacity of fully 850 tons, due to certain additions to the machinery and equipment finished during the month. This increase of capacity has been accomplished without any loss in the metallurgical efficiency of the plant.

Unofficial reports note an important ore strike on the 1000-ft. level.

Goldfield Annex—This mine has made a rich strike on the Poloverde claim at 770 ft. in the latite. A station will be cut at this level.

Humboldt County

Seven Troughs Coalition—The com-

pany has acquired the Kindergarten by exchange of stock and will continue development and start the mill soon. L. A. Friedman is in charge.

LINCOLN COUNTY

Occidental—The mill has been completed and will be in operation as soon as the cyanide equipment is finished.

Horseshoe—The mill is finished and will make a test run on ore from the Buck and Snowflake mines.

NYE COUNTY

Belmont—The improvement in the vein at the 1100-ft. level is considered important for the mine and the district.

Montana-Tonopah—This property is continuing extensive development and producing about 1000 tons weekly.

Tonopah Extension—The mill is now in operation, dropping 30 stamps.

Pennsylvania

BITUMINOUS COAL

Injured mine workers, or their dependent survivors—widows and children—are taking full advantage of the employers' liability act in the Circuit and District United States courts. Some substantial verdicts have been brought in by more or less sympathetic juries against coal companies, but as a rule, the damages were not excessive relative to the injuries sustained, particularlyly as the Federal judges insist very strictly that direct contributory negligence must be proved before he permits the case to go before the jury. On the other hand, the coal companies claim that they are put to great trouble and expense in defending petty and frivolous actions, which have for their sole purpose attempts to force the mining corporations to a settlement out of court.

Utah

JUAB COUNTY

A total of 141 cars of ore were shipped by the mines of the Tintic district for the week ended Jan. 21, as follows: Centennial Eureka, 43; Uncle Sam Consolidated, 4; Colorado, 21; Sioux Consolidated, 17; Iron Blossom, 26; Dragon Iron, 4; Grand Central, 2; Scranton, 6; Eagle & Blue Bell, 6; Gemini, 2; Ridge & Valley, 2; Chief Consolidated, 1; Yankee Consolidated, 4; Victoria, 2; Mammoth, 1.

Centennial-Eureka—A daily output of 350 tons of shipping ore is being maintained. About 250 men are employed on two shifts. The 2200-ft. drain tunnel which will tap the workings at 550 ft. below the shaft collar has been advanced from both ends, a total of nearly 1300 feet.

Colorado—About 70 men are employed. The mine is being operated on two shifts with an output of about 200 tons per day.

Iron Blossom—About 63 men are employed on two shifts. No. 1 shaft is producing about 75 tons per day and No. 3 120 tons. A depth of 455 ft. has been reached in the No. 3 shaft. A second level will be opened below the blanket vein now mined from the 385 level.

Chief Consolidated—A force of 50 men is employed. Sinking from the 1700 to the water level will soon be begun. Some ore is being shipped.

Gemini—The workings below the water level are flooded but pumps will be installed. Shipments are being maintained. J. C. McChrystal is general manager.

SALT LAKE COUNTY

Bingham-New Haven—From 70 to 80 tons of ore are being milled per 24 hours. H. G. Turley is superintendent.

United States Mining—Only one shift of 110 to 120 men is being worked. A daily output of 250 tons of lead ore is being maintained.

Highland Boy—A station is being cut on the 900 level and raising will connect at the 500 level with the vertical shaft. About one-third of the daily output of 800 tons is being produced from below the 700 or main tunnel level.

North Utah—Lead ore, carrying more gold and silver than heretofore, has been encountered in a stope which is being driven above the 227-ft. level of the Butler Liberal section of this property. The gold and silver content is new for this mine as the ore has been principally valuable for its lead. The new orebody which was opened recently on a lower hill is reported to be holding out well. A crosscut is being driven to open this ore north of the shaft.

SUMMIT COUNTY

Park City ore shipments, in pounds, for the week ended Jan. 22, were as follows: Silver King Coalition, 780,380; Little Bell, 269,000; American Flag, 130,800; Daly-West, 1,300,040; Daly-Judge, 844,000; Daly-Judge (zinc) 996,790; total, 4,321,010 pounds.

American Flag—Some of the working force has been laid off recently in the upper levels of this property. Development, however, is being pushed in the lower workings and good ore is reported on the 1100 level.

Little Bell Consolidated—The company paid its first dividend Dec. 22. A report to the stockholders at this time showed that during September, October and November, 1909, there was mined 1239 tons of ore which was sold for $43,935. During December 498 tons of ore were shipped to the smelteries which sold for $20,213. At the present time the production is between 450 and 500 tons per month.

Silver King Consolidated—The main working winze from the 1100 level has been sunk from the 1550 level to the 1600 level, a station cut and drifting begun. Work is being pushed on the 1550 level and considerable ore is being taken out. The ore is being mined from development work only, and a second shipment is now under way to the valley smelteries. The first shipment from the mine several weeks ago carried 65 to 70 oz. of silver, over 40 per cent. lead and about $4 gold. The testimony of the Silver King Consolidated vs. Silver King Coalition is being taken in the United States Court.

Washington

KING COUNTY

The United States Government has established a rescue station at the school of mines of the University of Washington, Seattle, for instructing and training miners in the use of the Draeger oxygen apparatus in mine-rescue work. This includes instructions on the subject of mine gases.

OKANOGAN COUNTY

Multnomah—F. O. Hudnutt, Nespelem, has charge of this property. Development is being done.

SNOHOMISH COUNTY

Red Cliff—P. J. Bardon, of Everett, has been appointed receiver of this property, near Berlin.

STEVENS COUNTY

Krug—The development work on this property is meeting with success. A tunnel is being driven to tap the vein at 300 ft., and the ore has improved. August Krug, Chewelah, is president.

Dead Medicine—This old mine is to be opened by the Clugston company, of Spokane. A 50-ton concentrator will be installed.

Wisconsin

ZINC-LEAD DISTRICT

Traffic conditions have somewhat improved and a number of mining companies forced to close down by lack of coal are again pumping. Prospecting has commenced after six weeks of inactivity. A new company was formed to develop a 20-acre tract northeast of the Klar-Piquette. The Meekers Grove Company has been reorganized under the name of the Jenkinsville Mining Company and will reopen the mine at Cuba City. The Wisconsin Zinc Company has taken option on the Lawrence prospect adjoining the Dall mine; this company will provide a concentrating mill at the Drum shaft, south of Benton.

Canada

BRITISH COLUMBIA

Consolidated—The plant at Trial in December smelted in the copper furnaces 36,094 tons, and in the lead furnaces 4263 tons. The product was 7580 oz.

gold, 186,829 oz. silver, 354,520 lb. copper and 3,332,140 lb. lead; total value, $395,214.

ONTARIO

New discoveries of high-grade ore have been made on the Mann and Bonsall properties at Gowganda.

Reeves-Dobie—Another 30-ton shipment of high-grade ore has been made from this Gowganda mine.

Beaver Lake—Silver has been found in the big smaltite vein at the 135-ft. level at South Lorrain.

ONTARIO-COBALT

For the week ended Jan. 21, 13 mines shipped 26 cars of ore as follows: La Rose, 256,059; Nipissing, 302,939; Drummond, 264,200; Kerr Lake, 182,392; Crown Reserve, 123,353; Cobalt Lake, 132,000; King Edward, 49,952; Buffalo, 47,644; O'Brien, 64,056; Right-of-Way, 64,902; McKinley-Darragh, 50,329; Temiskaming, 60,000; total 1,597,826 pounds.

Black—The big cobalt vein has been cut at the 200-ft. level but the silver contents are low.

Nancy Helen—This property has stopped work.

Right-of-Way—A 2000-oz. vein has been discovered on the 120-ft. level of the No. 3 shaft.

Sagdola—This property in the Gillies Limit has let a contract for a 100-ft. shaft.

McKinley-Darragh—An extension to the concentrator is under way which when completed will increase the capacity to 120 tons per day.

Cobalt Lake—Two carloads of ore were recently taken from the new vein at the south end of the property near the McKinley-Darragh. In one of these veins a decided improvement has taken place, the face showing 5 in. of high-grade ore. Drifting will connect the winze which has been sunk to the 250-ft. level with the shaft and other workings.

Trethewey—In following up the veins of the Hudson Bay property adjoining on the north end five veins of high-grade ore have been found, one of them being from 3 to 4 in. wide. A shaft is being sunk at this point.

Peterson Lake—The action brought by this company at Cobalt against Edward Steindler, David M. Steindler and Jacob A. Jacobs, was settled Jan. 19, Judge Teetzel acting as arbitrator. By his decision the defendants are to return to the company 160,000 shares of stock. Edward Steindler is to pay $50,000 to the company secured by sale of stock, and the company is given two years to repay a loan of $28,000 made by D. M. Steindler with 5 per cent. interest. The suit brought by the Peterson Lake company against the Nova Scotia for the cancelation of the lease held by the latter and $75,000 damages for ore claimed to have been wrongfully taken by the Nova Scotia from an area not included in the lease, is not affected by this settlement and is still in progress.

YUKON TERRITORY

Word has been received at Whitehorse of a rich find on claims owned by H. E. Porter in the Wheaton River valley.

Mexico

The failure of the U. S. Banking Company in Mexico City and the resulting closing of the bank's branches at Oaxaca and Parral, has caused inconvenience and loss to the large number of American mining companies using this institution in the course of business. Payrolls have been held up in consequence and several companies have their funds involved for a time. The bank is in the hands of a receiver and will be reorganized.

CHIHUAHUA

Prieta—The new milling plant will be put in operation during February.

Buena Tierra—An important lead-ore discovery is reported in this Santa Eulalia mine. It is also known that important zinc orebodies are being opened up in the lower levels.

Cienega—This company operating near Moris in the western part of the State recently marketed at Chihuahua one bar of gold bullion. Richard O'Leary is manager.

San Francisco del Oro—This Parral company is to resume on a large scale during March. It has been closed for several months pending the selecting of a suitable process for the refractory ores.

Parral Consolidated Mines Company—This company is shipping weekly to the Cia. Minera de Peñoles smeltery about 15 cars of silicious ore.

La Cruz—This property in the Ocampo section is being successfully opened under the direction of Thomas Williams, superintendent.

COLIMA

Florida—This mine, a short distance north of Manzanillo, is being reopened by R. M. Stadden, of Manzanillo.

DURANGO

Lustre—This Indé property has been sold at public sale for debts and has been bought in by S. H. McKee, of Pittsburg, Penn., representing the creditors. The company is in process of reorganization.

JALISCO

Los Ailes—Shipments of copper ore from 10 to 13 per cent. are being made from these properties in the Ayutla district.

Almoloya—A 3-stamp mill and concentrating plant have been purchased for experimental purposes by the company, recently organized in Mexico City to acquire the Almoloya mine, Ameca district.

Santa Rosa—This company, organized in 1907 to acquire the Santa Rosa, or Chinos group, Ayutla district, is starting operations. A 10-stamp concentrating and amalgamating plant will be placed in commission. G. W. Daines, Columbus, O., is at the head of the company.

SONORA

El Tigre—Construction work has started on a new mill near the site of the old one. It will be a cyanide plant, three times the capacity of the present mill.

Promotorio—Eastern men are negotiating for this property.

North Fortuna—This company, with holdings in the Sahuaripa district, has been granted concessions to install hydroelectric power, and to utilize the waters of the Mulatos river for that purpose.

Santa Rosalia—This company has just finished a wagon road to Cananea at an outlay of $30,000, and has begun to ship ore to Douglas on a moderate scale.

Richfield Copper—A shipment of ore was made from this company's mine at Tuape last week which averaged over 10 per cent. copper and 26 oz. of silver per ton. It was sent to Aguascalientes.

Creston-Colorado—Owing to the possibility of a cave-in, the mechanical shops of this company were moved to a different location and enlarged.

Sunset Development Company—A large force of men has been put to work on the coal lands of this company, near La Barranca. It is allied to the Southern Pacific railway.

ZACATECAS

San Cristobal and Zacatecas—The Zacatecas Mining and Metallurgical Company, capital $1,000,000, has been formed to work the San Cristobal and Zacatecas groups of gold mines in the Zacatecas district and engage in custom milling. The San Cristobal mines are equipped with hoisting, drilling and pumping machinery, a 30-stamp mill, amalgamating plates and vanners. The new company will install electric hoists, improve the milling plant and build a cyanide plant capable of handling 150 tons daily. Bernard MacDonald, of Guanajuato, is planning the cyanide annex.

Africa

WEST AFRICA

Gold production of the West Coast and Ashanti in December is reported by the West African Chamber of Mines at 17,570 oz. For the year ended Dec. 31 the output was 279,386 oz. bullion in 1908, and 235,972 oz. in 1909; a decrease of 61,414 oz. The bullion reported in 1909 was equal to $4,650,750, or 225,000 oz. fine gold.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, Feb. 2—Coal trade in the West is active, but is still suffering from car shortage and poor transportation.

In the East conditions in the bituminous trade are improving, though the short supply of cars is still in evidence. Trade generally is more active. The anthracite trade is steady, with no special changes.

Interest in the West centers on the wage conference at Toledo, O., which begins today. The mine workers are apparently prepared to insist on their demand for a 10 per cent. increase, while the operators seem equally determined to resist any advance. At the United Mine Workers' convention in Indianapolis there was a strong minority in favor of a general strike if the increase is not granted; but President Lewis deprecated extreme measures. It was resolved, however, that no district shall sign any agreement until all the district contracts are closed.

Coal Consolidation—A report comes from Pittsburg that a consolidation is being arranged of coal companies in the Youghiogheny district. Pittsburg men, with Clarkson & Co., of New York, are concerned. The merger, it is said, will include the Huff Company mines, holdings and railroads, the Kutz estate, its holdings and options; all the mineral rights and mines of the White's Creek branch of A. W. Cook & Co.; the Listonburg Coal Company, Elk Lick Coal Company, Somerset Fuel Company and the Smith, Myers & Co. mines at Anspach. It is the intention to build a dam on the Yough for a large electric plant. In the scheme is the extension of the Ursina & North Fork railroad in a northerly direction into Somerset county, opening up a virgin coal territory.

Coal Traffic Notes

Shipments of bituminous coal to Lake ports for two years are reported as below, in short tons:

District:	1908 Tons.	1908 PerCt.	1909 Tons.	1909 PerCt.
Pittsburg	8,700,000	55.2	8,687,305	55.8
Ohio	3,600,000	22.9	3,002,815	19.3
West Virginia	3,450,000	21.9	3,874,570	24.9
Total	15,750,000	100.0	15,564,690	100.0

The Ohio shipments showed a considerable decrease in 1909, and there was a corresponding increase in West Virginia coal.

Coal tonnage originating on the lines of the Southern railway, 11 months ended Nov. 30, was 2,397,640 in 1908, and 3,040,841 in 1909; increase, 649,201 tons.

New York

Anthracite

Feb. 2—Business continues good, as the weather has been favorable. Deliveries are easier.

Schedule prices for large sizes are $4.75 for lump and $5 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes quotations are, f.o.b. New York harbor points, according to grade: Pea, $3@3.25; buckwheat, $2.35@2.50; No. 2 buckwheat or rice, $1.85@2; barley, $1.40@1.50. The lower prices are generally for washery coal.

Bituminous

Conditions are a little better in the trade generally. Car supply is beginning to improve, though it is still far from what could be desired. Transportation is reasonably good, coal coming through in fair time when it is once loaded.

Demand seems to be improving generally and more coal is being taken, or at least asked for. Deliveries are still uncertain, the stocks at tidewater being low. Prices are about the same, a fair grade of steam coal bringing about $2.60, New York harbor, with better grades up to $3. Gas coal is still scarce.

The coastwise trade is unsettled. Rates are nominally unchanged, but vessel owners are holding back on account of uncertain and stormy weather.

Birmingham

Feb. 1—Coal operations in Alabama are active and the production is at the top notch. There is a demand for every ton of coal that can be mined and efforts are being made to lose no time. The railroads are big consumers. Shipments of coal out of the State are in good quantity and steady.

There is a good demand for coke and the production is being kept up to a high mark. The product brings a good price.

Chicago

Jan. 31—Conditions in the local coal market are nearly normal, as a result of the continuance of mild weather. Fine coals, however, continue to command a high price, Illinois screenings bringing $1.90@2.10. Receipts are much better of all kinds of coal, and it can hardly be said that any kind is abnormally scarce. The demand for both steam and domestic continues large and country dealers show a disposition to have good-sized stocks on hand for another cold wave. In the city deliveries are hampered yet by the large amount of snow on streets and tracks, but the situation has steadily improved.

Illinois and Indiana coals bring $2.75 @3.30; run-of-mine $2.15@2.35 and screenings $1.90@2.10. Both run-of-mine and screenings are in strong demand for steam purposes.

Coals from east of Indiana show less fluctuation, the supply in most cases being small enough to prevent anything like a slump. Hocking is in good and steady demand, at $3.15. Smokeless is moving more freely and selling at $3.75 @4 for lump, and $3.25@3.45 for run-of-mine. Youghiogheny is in good demand at $3.15 for steam and $3.30 for gas ¾-in., and receipts are better. The anthracite market shows steady conditions, with supplies large except of chestnut.

Cleveland

Jan. 31—More bad weather has made coal deliveries irregular and uncertain, and has disarranged car supply at mines. Stocks are short and it is not easy to get coal that is needed. Prices are nominally about the same, but premiums and extra charges are common. There is a heavy demand for slack, which cannot always be supplied, and in some cases it has brought as much as run-of-mine.

Indianapolis

Jan. 31—There is no diminution of the coal-mining activity in this State. The markets are freely taking all that can be produced. Coal traffic on the various railroads continues unusually heavy. Much coal is going to the southern States as well as to northern and northwestern States, and the dealers are having the busiest time in their history.

Pittsburg

Feb. 1—The conference between operators and the United Mine Workers, to be held in Toledo, O., was yesterday postponed from today until tomorrow, as the mine workers' convention at Indianapolis did not get through with its work yesterday. While the conference will last several days it is improbable any agreement will be reached without a second or possibly a third conference.

A possibility which does not seem to have been given any attention is that of attempts being made to organize the miners in the Connellsville region. Coke men thoroughly familiar with the situation there believe there is a strong pos-

sibility of the men in the Connellsville district being brought into a strike; that it would take very little to stir up trouble. In the great anthracite strike large tonnages of Connellsville coke and coal went out to relieve the situation and in a contest in the bituminous field the mine workers' leaders would doubtless turn their attention to Connellsville to prevent its interfering with their contest.

The local coal market is strong, but not particularly active. Prices remain quotable at $1.15 for mine-run and nut, $1.25 for ¾-in., $1.40 for 1¼-in. domestic, with slack at 85@90 cents.

Connellsville Coke—The market has continued very dull. Several furnaces have had coke shipments suspended. Coke prices are purely nominal, and quotable roundly at $2.50 for furnace, either prompt or contract, with foundry coke at about $3 for prompt and $3@3.25 for contract.

The *Courier* reports production in the Connellsville and lower Connellsville regions in the week ended Jan. 22, at 471,222 tons, a gain of 14,000. Shipments were 5211 cars to Pittsburg, 8708 cars to points west of Pittsburg and 1124 cars to points east of Connellsville, a total of 15,043 cars.

St. Louis

Jan. 31—The general market conditions on coal seem to be rather the reverse from what they were last week—locally the demand is very firm, while out-of-town trade seems to be slack. The warm weather continued throughout the week. The market would be much better off were it not for the fact that railroads have already begun storing coal against a strike in April, and some very large orders have been placed in the last 10 days. Several of the larger companies are entirely sold out from the present time up to April 1. Several of the larger railroads have been buying coal in lots of 500 and 1000 cars. This also has steadied the market and has taken surplus coal off the market.

The car situation seems to be getting worse and while such roads as the Iron Mountain and Illinois Central were already in as bad a shape as possible, it seems that the roads which are directly tributary to St. Louis and always have plenty of cars, are now also short. Mines on these roads are getting very little better than one-half time. Every mine on the Louisville & Nashville today was shut down on account of no cars.

Screenings have eased off a little, especially for out-of-town shipment. Fine coal of all kinds is still very high. A cold wave is in sight which will very likely bolster up the market again.

Standard 2-in. lump coal is firm at $1.25 at mine, or $1.77 St. Louis; 6-in. lump is bringing $1.75 mine, or $2.27 St. Louis; mine-run is $1 at mine, or $1.52 St. Louis; 3-in. nut is $1.20 mine, or $1.72 St. Louis; 2-in. pea and slack is $1 at mine and $1.52 St. Louis. The premium which was offered on coal that will move out of town is diminishing steadily and is now only about 10 to 15c. per ton above these prices. Screenings are worth 65c. at mine, or $1.17 St. Louis; ¾-in. pea and slack, 50c. at mine, or $1.02 St. Louis.

Staunton, Mt. Olive and Springfield district 6-in. lump is $1.75 at mine, or $2.27 St. Louis; 2-in. lump is now $1.60 at mine, or $2.12 St. Louis. Mine-run is $1.50 mine, or $2.02 St. Louis.

Carterville 6-in. lump is $1.80 and 6-in. egg is also $1.80 per ton, or $2.47 per ton St. Louis; 3-in. nut is $1.75 mine, or $2.42 St. Louis; 2-in. screenings are firm at 90c. mines, or $1.57 St. Louis.

Franklin County 6-in. lump is $2.25 mine, or $2.92 St. Louis; 3-in. nut is $2 at mine, or $2.67 St. Louis; 1½-in. screenings are $1.10 mine, or $1.77 St. Louis.

Anthracite is in strong demand, but dealers in general are buying sparingly as they do not care to carry any coal over for next season. Circular is being maintained, $6.95 for chestnut, stove or egg sizes, and $6.70 for grate.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, year ended Dec. 31, long tons:

	1908.	1909.	Changes
Anthracite	2,752,358	2,842,714	I. 90,356
Bituminous	9,100,819	9,693,843	I. 593,024
Total coal	11,853,177	12,536,557	I. 683,380
Coke	620,923	895,461	I. 274,538

Canada took in 1909 a total of 9,782,574 tons—2,802,361 anthracite and 6,980,213 bituminous—being 78 per cent. of the total exports. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, year ended Dec. 31, long tons:

	1908.	1909.	Changes.
Anthracite	16,483	4,709	D. 11,774
Bituminous	1,487,416	1,257,629	D. 229,787
Total coal	1,503,899	1,262,338	D. 241,561
Coke	129,591	170,671	I. 41,080

Canada furnished in 1909 a total of 1,043,419 tons of coal and nearly all the coke: Australia, 182,271 tons of coal; Japan, 14,344 tons coal. Imports are chiefly on the Pacific Coast and in the northwestern border States.

Welsh Coal Market—Messrs. Hull, Blyth & Co., Cardiff, report prices of coal as follows, on Jan. 22: Best Welsh steam, $4.14; seconds, $4.02; thirds, $3.90; dry coals, $3.96; best Monmouthshire, $3.60; seconds, $3.48; best small steam, $2.28; seconds, $2.04. All prices are per long ton, f.o.b. shipping port, less 2½ per cent. discount. Prices have hardened since the first of the year.

Iron Trade Review

New York, Feb. 2—Little by little the iron trade seems to be throwing off its waiting attitude, but progress is slow in most directions.

In pig iron there is more inquiry for basic and foundry iron. Producers now seem to be more willing to accept current prices for second-half delivery. Buyers are not inclined to pay more, and do not seem to be in any special hurry to close contracts.

In finished material there is more doing in structural steel, and inquiries are coming in for plates. The agricultural-implement people are beginning to talk about contracts for bars, and their requirements are expected to be large, as they are coming into the market at an unusually early date.

Pig Iron Production—The American Iron and Steel Association reports the make of pig iron in the United States in the second half of 1909 at 14,773,125 tons. This makes for the year 1909 a total of 25,795,471 long tons; which is 9,859,453 tons more than 1908, and 14,110 tons more than in 1907, heretofore the record year.

Baltimore

Feb. 1—Exports for the week included 4806 tons steel rails and 240 tons rail-joints to South Australia. Imports included 2313 tons spiegeleisen and 1164 tons manganese ore from Rotterdam; 1053 tons ferromanganese from Liverpool; 11,850 tons iron ore from Cuba.

Birmingham

Feb. 1—The new month starts in with a better feeling all around among the Southern pig-iron manufacturers. There is a better inquiry for the product with some sales. The quotations are strengthening, $14.50 being the figure given out. There is, however, still some $14 per ton, No. 2 foundry, iron to be had in this district, on quick delivery. The make in the Southern territory shows no improvement. Basic iron is in steady demand and brings a premium over the foundry iron. The inquiries received by Southern iron makers cover the first half of the year mostly, though a few requests are for prices for the third quarter.

Chicago

Jan. 31—Firmness continues in the iron market, with buying gradually extending into third-quarter needs and an increasing tonnage for the second-quarter contracted for. Malleable interests have continued to buy freely; regular foundry iron is still sluggish although a continuous, if slow, improvement is noted. Buying is mostly in small lots; the occasional sale over 1000 tons occurs often enough to swell the total to an increasing amount week by week. Second-quarter

deliveries are most sought by melters; on these Southern brings $14@14.50 Birmingham, or $18.35@18.85 Chicago. Northern holds to $19@19.50, with sales comparatively small, but selling interests satisfied with the situation.

Cleveland

Jan. 31—Ore sales are dropping off, most of the merchant ore for the season having been placed.

Pig Iron—The market is rather quiet locally though inquiries keep coming in. There has been some talk of low-priced Southern iron offered by second hands. No general change in prices is noted.

Philadelphia

Feb. 2—Great activity prevails in the accumulation of supplies of ore for future smelting. It is the policy of blast furnaces in this territory to carry heavy supplies of ore, coke and coal. Inquiries today among the leading brokers and makers show a quiet condition in pig iron. While there is not the slightest symptom of weakness an easier feeling prevails throughout the entire industry. Some weeks ago the possibilities of a further upward tendency were recognized. At the present time no such tendency is apparent. The business of the past week consisted of small orders for foundry iron, two or three large orders for pipe iron, the renewal of some contracts for forge iron, the purchase of a few small lots of malleable iron and negotiations for basic pig which are not yet closed owing to difference over price. Today's quotations are $19 for No. 2X foundry, $18 for forge and $18.50 for basic.

Pittsburg

Feb. 1—The second month of the new year opens with demand for finished-steel products improved in no respect, while during the first month there was a progressive moderation in the tone of enthusiasm with which the trade opened the year. There has been no change in finished-steel prices thus far this year. In pig iron there has been a gradual, though comparatively slight, weakening. In coke and scrap there has also been a slight downward trend.

Pig Iron—It has become known throughout the trade that some time ago, although just when is unknown, the Pittsburg Steel Company bought from a prominent firm of merchants in Pittsburg 9000 tons of basic pig iron for second-quarter delivery at $16.25, Valley, and 15,000 tons for third-quarter delivery at $16.75, Valley. It is insisted that the transaction does not accurately represent the market, since a billet trade was involved. It is a fact that the Pittsburg Steel Company has disposed of a large tonnage of billets in the past three months, and that a large part of the tonnage, if not all, found its way to the Jones & Laughlin Steel Company, which all told has taken in excess of 50,000 tons of billets from the outside. That it is to take more is very doubtful. Why there should have been such a storm of protest against the acceptance of the pig-iron transaction as representative of the market is not clear, for the average price involved would figure out $16.56¼, Valley, and it is known, from entirely independent sources, that prior to the news becoming public property basic pig iron was offered at $16.50, Valley, for February, March, April delivery. We quote the market at that price, representing a total decline of 75c. from the high point, reached early in November. Foundry iron is quotable 25c. lower than last week, at $16.75, Valley. Sales are reported to a Pittsburg interest of several hundred tons of No. 3 at $16.50 and a similar tonnage of No. 1 at $17.25. Bessemer remains at $19, Valley. The basic pig-iron average for January is announced at $16.87½ against $17 for December and $17.49 for November, and the bessemer average at $19, the same as in the two preceding months.

Steel—The billet market shows signs of becoming soft. Shipments are being held up and there is probably a larger tonnage of resale steel coming out than the market has yet felt. For the present last week's prices may be named as the apparent market; $27@27.50 for bessemer billets and $27.50@28 for open-hearth billets, with sheet-bars at $28.50 @29. Rods are nominally $33, but it would probably require a cut of $1 or more to effect any sales.

Ferromanganese—The market continues quiet, at about $44, Baltimore, for prompt shipment, freight to Pittsburg being $2.30 per ton.

Sheets—The market is quiet, but with mills so well sold ahead is firm and some mills refuse to sell at the open market, which remains quotable at 2.40c. for black and 3.50c. for galvanized, 28 gage, with blue annealed sheets, 10 gage, at 1.90c., and painted and galvanized corrugated roofing at $1.70 and $3 per square respectively.

St. Louis

Jan. 31—The market for pig iron has been very dull; buyers seem to be backward, so that few inquiries have been received and practically no business closed. Producers seem to have plenty of business to run them over and prices remain unchanged at $15 per ton Birmingham and $18.72 St. Louis.

Iron Ore—The market for Missouri 50 per cent. ore remains good at $3.75 per ton St. Louis. A good deal of interest is being shown in the ironfields of Wayne and Butler counties and a number of new projects are being formed to develop mines in that part of the country.

Foreign Trade in Iron and Steel

Exports and imports of iron and steel in the United States for the year ended Dec. 31 are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1908.	1909.	Changes.
Exports	$151,113,114	$157,680,331	I.$ 6,567,217
Imports	19,957,385	30,516,586	I. 10,559,201
Excess, exp.	$131,155,729	$127,163,745	D.$ 3,991,984

The leading items were as follows, in long tons:

	Exports		Imports	
	1908.	1909.	1908.	1909.
Pig iron	46,696	61,999	92,202	174,988
Scrap	21,834	25,360	5,090	63,504
Billets, blooms, etc.	122,177	104,862	11,212	19,913
Bars	52,105	87,960	19,671	19,206
Rails	196,510	299,540	1,719	1,513
Sheets and plates	104,993	180,048	2,629	4,720
Structural steel	116,881	90,830	3,623	6,146
Wire-rods	7,412	20,142	11,209	10,544
Wire	136,145	149,341	.....	.....
Nails and spikes	38,910	48,055	.....	.....
Pipe and fittings	114,362	162,140	.....	.....
Tinplates	11,879	9,327	58,490	62,593

The imports of wire not given in quantities: value of wire and manufactures thereof was $1,003,973 in 1908, and $1,117,812 in 1909. Quantities of rails and pipe imported are not given.

Iron Ore Movement—Imports and exports of iron ore in the United States, year ended Dec. 31, long tons:

	1908.	1909.	Changes.
Imports	776,898	1,696,411	I. 919,513
Exports	309,099	455,932	I. 146,833

The imports in 1909 included 927,774 tons from Cuba, 464,065 from Europe and 251,550 from Newfoundland and Canada. Exports were chiefly to Canada.

Manganese Ore—Imports of manganese ore into the United States, year ended Dec. 31, were 178,203 long tons in 1908, and 212,765 in 1909; increase, 34,562 tons.

Metal Markets

New York, Feb. 2—The metal markets continue quiet and rather uninteresting; with no important changes in prices to be noted this week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1909	$10,579,304	$ 2,083,772	Exp. $ 8,495,532
" 1908	7,357,707	5,152,732	" 2,204,975
Year 1909	132,883,821	44,086,966	" 88,793,855
" 1908	81,215,456	50,276,293	" 30,939,163
Silver:			
Dec. 1909	5,297,965	4,167,276	Exp. 1,130,689
" 1908	4,726,289	4,409,454	" 316,835
Year 1909	57,592,309	46,151,282	" 11,441,027
" 1908	51,837,671	42,224,130	" 9,613,541

Exports from the port of New York, week ended Jan. 29: Gold, $270,200, principally to Argentina; silver, $693,231, chiefly to London. Imports: Gold, $94,633; silver, $159,831, from South America and Mexico.

Gold—Prices on the open market in London are 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin. The Paris disaster is expected to call for shipments of gold, but probably not for two or three weeks yet. In New York shipments of gold to Argentina continue.

Platinum—Prices are unchanged, and dealers continue to quote $28.50@29 per oz. for refined platinum and $34.50 for hard metal. The market is easy.

Our special correspondent writes from St. Petersburg, Russia, under date of Jan. 20, that the market is a little better. Since Christmas some business has been done. There is, however, no activity. At Ekaterinburg a slow increase of prices is to be noted. The producers and small dealers ask for crude platinum 5.70 rubles per zolotnik—equal to $21.43 per oz. In St. Petersburg the prices are without change at 23,000@23.500 rubles per pood—$22.79 per oz. average.

Silver—The market held steady at 24⅞d. until Jan. 31, when it fell to 24d., and on Feb. 1 suffered a further drop to 23¾d. The market closes steady today at 23⅞d. in London.

SILVER AND STERLING EXCHANGE

Jan.-Feb.	27	28	29	31	1	2
New York....	52¼	52¼	52¼	52	51⅛	51¾
London ...	24⅛	24⅛	24⅛	24	23¾	23¾
Sterling Ex..	4.8630	4.8630	4.8620	4.8620	4.8625	4.8625

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Jan. 20, as reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India.....	£ 216,100	£525,500	I. £ 309,400
China.....	60,000	82,000	I. 2,000
Straits.....	61,000	.....	D. 61,000
Total.....	£ 357,100	£607,500	I. £ 250,400

India Council bills in London sold at an average of 16.09d. per rupee.

Copper, Tin, Lead and Zinc

Jan.-Feb.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
27	13⅝ @13⅞	13⅛ @13⅜	60 1/16	32⅜	4.70	4.50 @4.55	5.80 @5.85
28	13⅝ @13⅞	13⅛ @13⅜	60 3/16	32½	4.70	4.50 @4.55	5.75 @5.80
29	13⅝ @13⅞	13⅜ @13⅜	....	32⅝	4.70	4.50 @4.55	5.70 @5.75
31	13⅝ @13⅞	13⅜ @13⅜	60¾	32⅝	4.70	4.50 @4.55	5.65 @5.70
1	13¾ @13⅞	13⅜ @13⅜	60 5/16	32¾	4.70	4.55	5.65 @5.70
2	13¾ @13⅞	13⅜ @13⅜	59½	32⅝	4.70	4.55	5.65 @5.70

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market has been an uninteresting affair throughout the week. The unsettled condition in the London standard market and the nervousness of the stock exchanges in financial centers has created a feeling of hesitancy among manufacturers, who, while they are busy to the limit of capacity, complain that new orders are not forthcoming freely. As a result, transactions in the metal have been of small volume, and the tone at the close is somewhat easier at 13¾ @13⅞c. for Lake copper, and 13⅜@ 13⅝c. for electrolytic copper in cakes, wire bars and ingots. Casting copper is quoted nominally at 13¼@13½ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 15¼c. base, carload lots at mill. Business is very good.

The London standard market, after advancing on Thursday of last week to £61 for spot and £61 15s. for three months, has been depressed ever since, and closes weak at £59 12s. 6d. for spot, and £60 10s. for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.; best selected, £63 10s.@£64; strong sheets, £73 10s.@£74 10s. per ton.

Copper exports from New York and Philadelphia for the week were 6710 long tons. Our special correspondent gives the exports from Baltimore at 542 tons.

The January Market—January opened with electrolytic copper at 13⅝@13¾c. and a fair demand which continued up to about Jan. 10. Since then the volume of business transacted has been small, the decline in the price at London below our parity cutting off the chances of sales for delivery abroad, except at concessions which the producers have been reluctant to make. However, producers freely offered copper at the equivalent of 13.60, cash New York, and did some domestic business at that price until toward the end of the month when there was some tendency to make further concessions, the month closing on the basis of about 13½c. The characteristic of the market during January was inaction.

Tin—Notwithstanding the very unfavorable statistical position which was unfolded the last day of January, the market remains steady. The only redeeming feature which the statistics disclosed was the comparatively large deliveries for consumption in this country. They are estimated to have been 3500 tons, or practically 500 tons more than in previous months. There are no special features reported from London, and the close is steady at £147 15s. for spot, and £149 7s. 6d. for three months.

There seems to be still a scarcity of spot material in this market, but the late arrivals have brought about a reduction in the premium which is asked. At the close, tin is quoted at 32⅝ cents.

Visible stocks of tin on Feb. 1: London, 13,098; Holland, 3015; United States, excluding Pacific ports, 6911; total, 23,024 long tons, an increase of 2106 tons during January.

Tin output of the Federated Malay states is reported at 48,002 long tons in 1909; a decrease of 2435 tons from the previous year.

Lead—The market is unchanged at 4.55 St. Louis, and 4.70 New York.

The London market is slightly lower at £13 7s. 6d. for Spanish lead and £13 10s. for English lead.

Spelter—The market for this metal has been demoralized. Galvanizers are well covered, on the one hand, while smelters are pressing their metal for sale on account of the liberal ore supplies which they are receiving from all quarters. Prices have declined sharply from day to day, and the close is weak at 5.65 @5.70c. St. Louis, and 5.80@5.85c. New York.

New York quotations for spelter, Jan. 27, were 5.95@6c.; Jan. 28, 5.90@5.95c.; Jan. 29, 5.85@5.90c.; Jan. 31 to Feb. 2, inclusive, 5.80@5.85 cents.

The London market is unchanged at £23 5s. for good ordinaries, and £23 10s. for specials.

Base price of sheet zinc has been reduced ¼c. per lb., and is now $7.75 per 100 lb. f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Antimony—Business remains quiet. Prices are unchanged. Cookson's may be quoted at 8½c. per lb., and U. S. 8c., with 7⅝@7⅞c. named for outside brands.

Aluminum—Current quotations are 20 @22c. per lb. for No. 1 ingots.

Quicksilver—New York prices are weaker at $50@52 per flask of 75 lb.; jobbers ask 72c. per lb. for small lots. San Francisco, $50@51 for domestic orders and $2 per flask less for export. London price is £9 15s. per flask; jobbers quoting 2s. 6d. less.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 200-lb. lots, up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots f.o.b. New York.

Cadmium—Current quotations are 65 @70c. per lb. in 100-lb. lots at Cleveland, Ohio. In Germany 450@475 marks per 100 kg., at factory in Silesia.

Imports and Exports of Metals

Exports and imports of metals in the United States, year ended Dec. 31, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	312,407	143,661	Exp. 168,746
Copper, 1908....	301,080	97,636	Exp. 203,444
Tin, long tons....	437	42,567	Imp. 42,130
Tin, 1908.....	244	36,832	Imp. 36,588
Lead, short tons.	86,077	114,182	Imp. 28,105
Lead, 1908.....	76,354	112,074	Imp. 35,720
Spelter, sh. tons.	2,566	9,670	Imp. 7,104
Spelter, 1908....	2,640	881	Exp. 1,759
Nickel, lb.....12,048,737	21,916,182		Imp. 9,867,445
Nickel, 1908.... 9,770,248	16,586,423		Imp. 6,816,175
Antimony, lb.....	6,648	9,652,568	Imp. 9,645,920
Antimony, 1908.	1,763	8,114,651	Imp. 8,112,888
Platinum, oz.....	.....	118,851	Imp. 118,851
Platinum, 1908.		50,768	Imp. 50,768
Quicksilver, lb ..	510,221	.....	Exp. 510,221
Quicksilver, '08	224,692	.....	Exp. 224,692
Aluminum, value	$567,375	.....	Exp. $567,375
Aluminum, 1908	330,092	.....	Exp. 330,092
Ores, etc.:			
Zinc oxide, lb. ..29,691,347	.....		Exp.29,691,347
Zinc oxide, '08..24,016,254	.....		Exp.24,016,254
Zinc dross, lb....14,138,898	.....		Exp.14,138,998
Zinc dross, '08..16,810,259	.....		Exp.16,810,259
Zinc ores, lg.tons	11,121	47,996	Imp. 36,875
Zinc ores, 1908.	23,311	102,545	Imp. 79,234
Antim'y ores, lb.	504	3,386,708	Imp. 3,386,204
Ant. ores, 1908.	9,694	3,282,218	Imp. 3,272,524
Chrome ore, tons	30	39,820	Imp. 39,790
Chrome ore, '08	.....	.....	.....

Copper, lead and nickel (and antimony from Aug. 5, 1909) include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Chrome ore was not reported separately last year. Zinc contents of ore imported, August-December, 1909, were 18,858,044 lb.; not reported prior to date of new tariff.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 29—The highest price paid this week for zinc ore was $49 per ton; the base price, 60 per cent. zinc, was $46@47.50. The base price of lead ore was $56@57 per ton.

SHIPMENTS, WEEK ENDED JAN. 29.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.....	446,000	.....	.....
Benton.....	315,300	.....	.....
Galena.....	256,700	.....	.....
Council Hill.....	80,000	.....	.....
Cuba City.....	79,000	.....	.....
Shullsburg.....	75,000	.....	.....
Montfort.....	70,000	60,000	.....
Harker...	64,450	.....	.....
Highland.....	60,600	.....	.....
Platteville.....	86,700	.....	493,810
Hazel Green.....	.....	144,700	.....
Linden.....	.....	63,360	.....
Total.....	1,533,750	268,060	493,810
Year to Jan. 29.....	5,199,997	618,229	1,326,680

Shipped to separating plants, 1,728,570 lb. zinc ore for the week.

Joplin, Mo., Jan. 29—The highest price paid for zinc sulphide ore was $49.50, the base $45@47 per ton of 60 per cent. zinc. The highest price paid for zinc silicate ore was $29, the base $24@27 per ton of 40 per cent. zinc. The average price, all grades, was $44.36. While most of the lead ore shipped this week was purchased last week at $58 per ton, the price dropped in midweek to $56 and at the week end to $54. The average price, all grades, was $56.40 per ton.

The zinc shipment was a good average, while the lead shipment was heavy, with both ores weak at the close. Good zinc ore sold today on a base of $45, assaying 61 per cent. zinc, and small-lot offerings of producers found no takers at this price. The market was thoroughly demoralized, with some purchasing agents endeavoring to turn ore to other purchasing agents at net cost, in cases where a carload or two had been purchased more than ordered by the smelting company.

SHIPMENTS, WEEK ENDED JAN. 29.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,294,010	1,174,960	$130,100
Joplin.....	1,873,360	306,370	52,602
Jackson.....	448,650	465,480	23,351
Miami.....	750,310	221,810	20,840
Duenweg.....	517,010	199,490	17,822
Galena.....	660,390	99,080	17,534
Alba-Neck.....	402,120	5,990	9,811
Carthage.....	335,040	.....	8,040
Quapaw.....	316,870	.....	6,811
Granby	368,000	10,000	6,430
Badger.....	256,170	.....	6,019
Cave Springs.....	253,350	.....	5,699
Aurora.....	266,500	.....	4,863
Spurgeon.....	192,080	46,160	4,207
Oronogo.....	27,720	126,340	3,991
Sarcoxie.....	137,980	.....	3,039
Stott City.....	62,840	.....	1,444
Totals	11,162,400	2,655,680	$322,603
The month.....	49,672,670	9,091,840	$1,386,364
Zinc value, the week,	$247,597;	the mo.,	$1,125,244
Lead value, the week,	75,006;	the mo.,	261,120

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January.....	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February.....	36.94	.....	34.37	.....	50.50	.....
March.....	37.40	.....	34.71	.....	50.82	.....
April	38.63	.....	37.01	.....	55.63	.....
May.....	40.06	.....	37.42	.....	56.59	.....
June.....	44.15	.....	40.35	.....	57.52	.....
July.....	43.06	.....	41.11	.....	53.74	.....
August	48.25	.....	44.54	.....	57.60	.....
September ..	47.70	.....	44.87	.....	56.11	.....
October.....	49.50	.....	45.75	.....	55.02	.....
November...	51.31	.....	48.29	.....	53.94	.....
December...	49.45	.....	47.57	.....	55.26	.....
Year.....	$43.98	.....	$41.20	.....	$54.60	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Feb. 2—Business continues steady in most lines, with a tendency to improvement.

The General Chemical Company has increased its quarterly dividend on the common stock from 1 to 1¼ per cent., and has also declared an extra dividend of 10 per cent., payable in new stock.

Copper Sulphate—Prices are unchanged at $4.10 per 100 lb. for carload lots and $4.35 per 100 lb. for smaller parcels.

Nitrate of Soda—The quotations are steady at 2.10c. per lb. for spot and 2.07½c. for futures. Business is not active.

Arsenic—Sales have been light during the week. Quotations are $2.70@2.75 per 100 lb. for white arsenic.

Imports and Exports—Imports and exports of chemicals and raw materials in the United States, year ended Dec. 31.

	Imports.	Exports.	Excess.
Copper sulph. lb.		2,965,713 E.	2,965,713
Copper sul., '08		7,663,882 E.	7,663,882
Bleach, lb.....	91,390,004	13,964 I.	91,376,040
Bleach, 1908....	74,602,059	121,511 I.	74,480,548
Potash salts, lb..	427,215,696	2,338,414 I.	424,877,282
Potash salts, '08	300,927,536	1,046,689 I.	299,880,847
Soda salts, lb....	15,697,637	1,053,410 I.	14,644,227
Soda salts, 1908	11,376,614	838,852 I.	10,537,762
Acetate lime, lb.		72,312,173 E.	72,312,173
Acetate, 1908...		56,703,015 E.	56,703,015
Nit. of soda, tons	422,593	8,233 I.	414,360
Nitrate, 1908...	310,713	9,955 I.	300,758
Phosphates, tons	11,903	1,058,760 E.	1,046,857
Phosphates, '08	26,734	1,228,989 E.	1,222,255
Sulphur, tons....	26,914	37,142 E.	10,228
Sulphur, 1908..	20,118	27,894 E.	7,776
Pyrites, tons.....	692,385	..... I.	692,385
Pyrites, 1908...	668,115	..... I.	668,115
Magnesite, lb....	84,814,624	880,175 I.	83,934,449
Magnesite, 1908	.....	.....	.....

Exports include reëxports of foreign material. Figures for magnesite are for six months, July-December; not reported separately prior to July 1, 1909. Estimating sulphur contents of pyrites, the total imports of sulphur in 1909 were 303,838 tons.

Mining Stocks

New York, Feb. 2—Following last week's flurry and excitement, the general stock market this week has been irresolute and uninteresting. It has been a trader's market of small fluctuations and a tendency to weakness.

There were several sales of Homestake, of South Dakota, 510 shares changing hands at $88.62½@88.50 per share.

The Curb, like the Exchange, was dull and undecided, with small fluctuations and general declines. The copper shares showed the largest business, but there was some trading in Cobalts and Nevadas. Copper share prices closed rather weak.

Boston, Feb. 1—Copper shares have continued reactionary but the forced liquidation in stocks which have lately been boomed so hard has cleared the atmosphere to a considerable extent. Lake Copper found a low at $60 per share, after having made a high at $94.50. The recovery was quite sharp up to $79. In the general reaction, North Lake and Indiana both fell steadily, but recoveries were equally quick, so that net gains are recorded.

Calumet & Arizona recovered $10 during the week, although not all of this was net. Mohawk has been especially strong and made a gain of $3, to $71, ex-dividend. Franklin made a spurt of $2.25 to $20.25 on expectation of striking the Hancock lode. Hancock Mining had a $4 advance on light trading up to $29. Amalgamated benefited to the extent of over $5 by the reports regarding the copper merger.

South Lake and Oneco have been the active Curb features. The latter company has levied an assessment of $1 per share, payable Feb. 15. As there are 75,000 shares of stock outstanding, the company will acquire $75,000 to continue development work.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
II, 1909	103,700,817	43,578,118	30,968,496
III	117,058,661	48,871,964	59,191,043
IV	113,574,292	47,546,010	65,110,111
V	118,356,146	61,163,325	70,542,753
VI	116,567,493	60,591,116	70,966,457
VII	118,277,603	75,520,083	75,018,974
VIII	120,597,234	59,614,207	48,382,704
IX	118,023,139	52,105,955	50,077,777
X	124,657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910	....	....	....

VISIBLE STOCKS.

	United States.	Europe.	Total.
II, 1909	144,130,045	118,574,400	262,704,445
III	173,284,248	117,140,800	290,425,048
IV	182,279,902	115,024,000	297,303,902
V	183,198,073	114,050,320	297,248,393
VI	169,848,141	127,352,960	297,201,101
VII	154,858,061	150,928,960	305,787,021
VIII	122,596,607	171,492,160	294,088,767
IX	135,196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910	141,766,111	244,204,800	385,970,911
II	....	248,236,800	....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	.....	23.706	.....
March	50.468	.....	23.227	.....
April	51.428	.....	23.708	.....
May	52.905	.....	24.343	.....
June	52.438	.....	24.166	.....
July	51.043	.....	23.519	.....
August	51.125	.....	23.588	.....
September	51.440	.....	23.743	.....
October	50.923	.....	23.502	.....
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.726	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK. Electrolytic		NEW YORK. Lake.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	.....	13.295	.....	57.688	.....
March	12.387	.....	12.826	.....	56.231	.....
April	12.56¼	.....	12.93⅞	.....	57.363	.....
May	12.893	.....	13.238	.....	59.338	.....
June	13.214	.....	13.548	.....	59.627	.....
July	12.880	.....	13.363	.....	58.556	.....
August	13.007	.....	13.296	.....	59.393	.....
September	12.870	.....	13.210	.....	59.021	.....
October	12.700	.....	13.030	.....	57.551	.....
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	27.380	32.700	July	29.207	.....
February	28.978	.....	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	.....	3.868	.....	13.313	.....
March	3.986	.....	3.835	.....	13.438	.....
April	4.168	.....	4.051	.....	13.297	.....
May	4.287	.....	4.214	.....	13.225	.....
June	4.350	.....	4.291	.....	13.031	.....
July	4.321	.....	4.188	.....	12.563	.....
August	4.363	.....	4.227	.....	12.475	.....
September	4.342	.....	4.215	.....	12.781	.....
October	4.341	.....	4.215	.....	13.175	.....
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	.....	4.739	.....	21.563	.....
March	4.757	.....	4.607	.....	21.438	.....
April	4.965	.....	4.815	.....	21.531	.....
May	5.124	.....	4.974	.....	21.975	.....
June	5.402	.....	5.252	.....	22.000	.....
July	5.402	.....	5.252	.....	21.969	.....
August	5.729	.....	5.579	.....	22.125	.....
September	5.796	.....	5.646	.....	22.906	.....
October	6.199	.....	6.043	.....	23.200	.....
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

STOCK QUOTATIONS

COLO. SPRINGS Feb. 1

Name of Comp.	Bid.
Listed:	
Acacia	.06
Cripple Cr'k Con.	.02⅞
C. K. & N.	.11
Doctor Jack Pot	.08¾
Elkton Con.	.69⅞
El Paso	.67½
Fannie Rawlins	.07
Findlay	.10⅞
Gold Dollar	.10
Gold Sovereign	.03½
Isabella	.19⅛
Mary McKinney	.46¼
Pharmacist	.03
Portland	1.02
Vindicator	.77
Work	.06
Unlisted:	
Golden Cycle	1.40
United Gold Mines	.09⅞

S. LAKE CITY Feb. 1

Name of Comp.	Clg.
Carisa	.50
Colorado Mining	.76
Columbus Con	.77
Daly Judge	4.40
Grand Central	1.77½
Iron Blossom	.85
Little Bell	1.92½
Little Chief	.45
Lower Mammoth	.50
Mason Valley	2.15
Maj. Mines	2.32½
May Day	.19½
Nevada Hills	‡.60
New York	.13
Prince Con	.90
Red Warrior	6.00
Silver King Coal'n	3.50
Sioux Con	.33½
Uncle Sam	.42
Victoria	‡1.50

SAN FRANCISCO. Feb. 1.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		MISC. NEVADA	
Atlanta	‡.11	Belmont	1.42
Belcher	1.12	Jim Butler	.11
Best & Belcher	.85	MacNamara	.26
Caledonia	.49	Midway	.23
Challenge Con	.31	North Star	‡.01
Chollar	.29	West End Con	.21
Confidence	‡1.35	Atlanta	.12
Con. Cal. & Va	1.82	Booth	‡.09
Crown Point	1.10	C.O.D. Con	‡.06
Exchequer	‡.30	Columbia Mt.	‡.05
Gould & Curry	.37	Comb. Frac.	.32
Hale & Norcross	.63	Goldfield Belmont	‡.90
Mexican	1.70	Goldfield Daisy	.98
Ophir	2.02	Jumbo Extension	.22
Overman	.68	Oro	‡.03
Potosi	.70	Red Hill	.03
Savage	.47	Sandstorm	‡.04
Sierra Nevada	.73	Silver Pick	.07
Union	.86	St. Ives	‡.12
Yellow Jacket	‡1.30		

N. Y. EXCH. Feb. 1

Name of Comp.	Clg.
Amalgamated	81⅞
Am. Agri. Chem.	44½
Am.Sm.&Ref.,com	91⅜
Am. Sm. & Ref., pf.	109
Anaconda	51
Bethlehem Steel	30½
Col. & Hock. C. & I.	14
Colo. Fuel & Iron	37¾
Du Pont P'd'r, pf.	85¼
Federal M. & S.	‡85
Great Nor., orectf.	72
Nat'nalLead,com.	83¾
National Lead, pf.	109
Pittsburg Coal	21⅞
Republic I&S,com.	35⅛
Republic I & S, pf.	‡100
SlossSheffi'd,com.	‡77
Sloss Sheffield, pf.	118½
Tennessee Copper	34¼
Utah Copper	50⅝
U. S. Steel, com.	82⅝
U. S. Steel, pf.	122⅞
Va. Car. Chem.	52

N. Y. CURB Feb. 1

Name of Comp.	Clg.
Big Vein Copper	8⅞
Bonanza Creek	3
Boston Copper	19¾
Braden Copper	4⅞
B. C. Copper	7⅜
Buffalo Mines	3½
Butte Coalition	26½
Chino Copper	13
Cobalt Central	.18
Combination Fra.	.32
Con. Ariz. Sm.	2 1/16
Cumberland Ely.	9
Davis-Daly	3¾
Dominion Cop.	7
Ely Con	.90
El Rayo	2⅝
Florence	2⅝
Gila Copper	8⅛
Giroux	10½
Gold Hill	1⅜
Goldfield Con	7 9/16
Greene Cananea	9¾
Guanajuato	2
Guggen. Exp.	241½
Kerr Lake	.08 1/16
La Rose	4 7/16
McKinley-Dar-Sa.	.85
Miami Copper	24¾
Mines Co. of Am.	48
Montezu. of C. R.	3
Mont. Shoshone	1
Mont.-Tonopah	.70
Nev. Utah M. & S.	1⅜
Newhouse M. & S.	3½
Nipissing Mines	10⅛
Ohio Copper	4 7/16
Pacific Sm. & M.	1⅛
Silver Queen	.21
Standard Oil	645
Stewart	5/16
Tonopah	6⅝
Tonopah Ex	.72
Tri-Bullion	1⅛
Utah Apex	5⅛
Yukon Gold	5

LONDON Feb. 2

Name of Com.	Clg. £	s	d
Dolores			
Stratton'sInd.	0	3	3
Camp Bird	1	7	6
Esperanza	2	19	6
Tomboy	0	17	6
El Oro	1	8	0
Oroville	0	9	0

‡Last quotation.

BOSTON EX. Feb. 1

Name of Comp.	Clg.
Adventure	9½
Allouez	48
Am. Zinc	31¾
Arcadian	7⅞
Arizona Com	41½
Atlantic	9¾
Boston Con	19¾
Calumet & Ariz.	73
Calumet & Hecla	640
Centennial	29
Con. Mercur	.11
Copper Range	79
Daly-West	8¾
East Butte	10⅜
Franklin	20⅜
Greene-Can.	9⅜
Hancock	25¼
Isle Royal	23
Keweenaw	5
La Salle	16
Mass	8¾
Michigan	7¼
Mohawk	69½
Nevada	23½
North Butte	39⅞
Ojibway	9½
Old Dominion	46½
Osceola	154
Parrot	19⅞
Quincy	84
Shannon	15⅝
Superior	58½
Superior & Bost.	14¼
Superior & Pitts.	14¼
Tamarack	72
Trinity	9
U. S. Smg. & Ref.	47½
U.S.Sm. & Re., pd.	50¾
Utah Con	40
Victoria	4½
Winona	10
Wolverine	140
Wyandotte	2⅝

BOSTON CURB

Name of Comp.	Clg.
Ariz. Mich	‡.95
Ahmeek	210
Bingham Mines	2½
Boston Ely	3¾
Calaveras	6⅜
Champion	.09
Chemung	‡11¾
Chino	13
Corbin	.16¾
Cactus	5⅝
Crown Reserve	‡5 1/16
First Nat. Cop.	5⅛
Gila Copper	8¾
Indiana	34½
Majestic	.88
Ray Central	3¾
Ray Con	23⅞
Rawhide Coal	.17
Rhode Island Coal	11
San Antonio	‡8½
South Lake	12½
Trethewey	..
Vulture	9
Yuma	1¾

ST. LOUIS Jan. 29

N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.09	.07
Center Cr'k	‡2.00	‡1.75
Cent.C.&C.	86.00	85.00
C.C. & C. pf.	85.00	84.00
Cent. Oil	110.00	100.00
Columbia	9.00	7.00
Con. Coal	20.00	18.00
Doe Run	110.00	100.00
Gra. Bimet.	.33	.30
St. Joe	13.00	12.00

Assessments

Company.	Delinq.	Sale.	Amt.
Adventure Con. Cop., Mich.	.....	Feb. 1	$1.00
Arcadian Copper, Mich.	.....	Mar. 1	0.50
Argenta, Ida.	Feb. 10	Mar. 10	0.001
Bullion, Nev.	Jan. 11	Mar. 1	0.05
Con. Imperial, Nev.	Jan. 11	Feb. 3	0.01
Con. Virginia, Nev.	Dec. 20	Jan. 10	0.25
Exchequer, Nev.	Dec. 15	Jan. 5	0.05
Gordon M. & M., Utah	Jan. 15	Feb. 4	0.002
Hancock Min., Mich.	.....	Feb. 1	1.00
Maxfield, Utah	Jan. 31	Feb. 19	0.00½
Ojibway, Mich	Mr.Oct.	.....	2.00
Precious Metals M. & M., Cal.	Dec. 27	Jan. 31	0.01
Rexall S. & C., Utah	Feb. 13	Mar. 15	0.01
Savage, Nev.	Feb. 10	Mar. 8	0.10
Seven Bros.-Pioche, Nev.	Jan. 15	Feb. 4	0.002
Sheba Gold & Silver, Utah	Jan. 19	Feb. 23	0.05
Sierra Nevada, Nev.	Jan. 11	Feb. 3	0.10
Silver King Con., Utah	Jan. 17	Feb. 5	0.10
Utah Ideal, Utah	Feb. 1	Feb. 20	0.00½
Wabash, Utah	Feb. 21	Mar. 15	0.05
Western Monitor, Utah	Feb. 1	Mar. 1	0.00½

THE MINING INDEX

A CLASSIFIED BIBLIOGRAPHY OF THE CURRENT LITERATURE OF MINING AND METALLURGY.

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons if so requested.

AMMONIA AND AMMONIUM SULPHATE

11581—AMMONIA PRODUCTION in 1909. C. G. Atwater. (Eng. and Min. Journ., Jan. 15, 1910; ½ p.) 20c.

ANTIMONY

11582—OCCURRENCE AND USE of Antimony. D. W. Weston. (Pac. Miner, Nov., 1909; 3 pp.) 20c.

CEMENT

11583 — PROGRESS IN CEMENT INDUSTRY—Neuere Fortschritte in der Zement-, Kalk-, Phosphat- und Kalliindustrie. C. Naskel. (Zeit. des Vereines deutscher Ing., Jan. 1 and 8, 1910; 14½ pp., illus.)

COAL AND COKE

11584—ACCIDENTS—Fatal Accidents in Coal Mines of North America. Frederick L. Hoffman. (Eng. and Min. Journ., Dec. 25, 1909; 3¼ pp.) 20c.

11585—BRIQUETTING—The Standard Briquette Fuel Company's Plant at Kansas City. Charles T. Malcomson. (Am. Coal Journ., Jan., 1910; 9 pp., illustrated.) 20c.

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Emery, in kegs; Turkish flour	"	.01¾@.02
Grains	"	.03½@.04
Naxos flour	"	.01¾@.02
Grains	"	.03½@.04
Chester flour	"	.01½@.02
Grains	"	.03½@.04
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Italian, powdered	per lb.	.01¼@.01½
Lump, per quality	"	.03½@.30
Rottenstone, ground	"	.02@.04
Lump, per quality	"	.04@.20
Rogue, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07½@.07¾
ACIDS—		
Acetic 28%	lb.	.02¾
Boric	"	.07
Hydrofluoric, 30%	"	.02¾@.03½
" 48%	"	.05½
" 52%	"	.06
" 60%	"	.09@.10
Hydrochloric acid, 20° per 100 lb.		1.15@1.50
Nitric acid, 38°	per lb.	.03½@.04½
Sulphuric acid, 50°, bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.10
66°, bulk, ton		18.00
Oxalic	per lb.	.07½@.07½
ALCOHOL—Grain 95%	gal.	2.61
Denatured	"	.42@.44
Refined wood, 95@97%	"	.52@.57
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.04¾@.04½
ALUMINUM—Sulphate, com'l.	lb.	1.50@1.75
AMMONIA—24 deg. lb.	"	.04½@.05½
" 26 deg. lb	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.28
Carbonate	"	.08@.08¾
Muriate grain	"	.05¾@.06½
Lump	"	.09½@.09½
Sulphate, 100 lb.	"	2.65@2.75
Sulpho-cyanide com.	"	.30
" chem. pure	"	.40
ANTIMONY—needle, lump	lb.	.04½@.04¼
Oxide	"	.07¾@.08
ARSENIC—white	"	.02¼@.02¾
Red, Outside brands	"	.07
Saxony	"	.07½@.08
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Barbadoes	per ton.	50.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.11@.16
Gilsonite, Utah ordinary	per ton.	32.00@40.00
Trinidad	"	20.00@25.00
California	per ton.	25.00@30.00
BARIUM—		
Carb. Lump. 80@90%	lg. ton.	26.00@35.00
Precipitated, 96@98%	"	34.00@36.00
Chloride com'l	ton.	35.00@38.00
Nitrate powdered, in casks	lb.	.05@.06½
Blanc Fixe, dry, bbl	per lb.	.02¾@.03½
BARYTES—		
Am. Ground	sh. ton.	12.00@15.00
Floated	"	17.00@19.00
Foreign floated	"	20.00@23.00
BLEACHING POWDER—35% 100 lb		1.25@1.50
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.		4.10@4.35
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BORAX, sacks	"	.03¾@.05
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Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	11.00@14.10
CEMENT—		
Portland, Am. 500 lb	bbl.	1.50@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb.	"	.85
(in sacks)	"	.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton.	14.00@16.00
Bricks, f.o.b. Pittsburg, per M.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton.	7.00@10.00
Foreign	"	10.00@20.00
COBALT—Oxide	lb.	.80@.85
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.80
In bags	"	.60@.75
CRYOLITE (carload)	lb.	.06½@.07
FELDSPAR—Ground	sh. ton.	6.00@14.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20.00@23.00
Special extra	"	30.00@35.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. Pittsburg:		
Lump	ton.	8.00@10.00
Ground	"	12.00@14.00
Foreign crude ex. dock	"	8.50
FULLER'S EARTH—Lump, 100 lb.		.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02@.04
Dust	"	.02½@.05
Chip	"	.04@.08
Lump	"	.05½@.12
Large lump	"	.08¼@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01¾@.02½
German	"	.02¼@.02¾
LEAD—Acetate (sugar of) brown,	lb.	.07¾@.08
Nitrate, com'l	"	.08@.08¼
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.50@8.50
Calcined, powdered	sh. ton.	26.00@37.00
Brick, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.90@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@.01½
75@85% binoxide	"	.01¼@.01½
85@90% binoxide	"	.01½@.04
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16.00@32.50
MARBLE—Flour	sh. ton.	7.00@9.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, normal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.10½@.11
Sulphate, double	"	.05⅞@.08
NITRATE OF SODA—		
100 lb. 95%		2.07½@2.10
95% for 1910		2.07½@2.10
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.06½@.06¾
English glassmakers'	"	.08¼@.09½
Lithopone	"	.03½@.07
Metallic, brown	sh. ton	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	8.50@9.00
Best	"	12.00@15.00
Dutch, washed	lb.	.02¾@.03
French, washed	"	.01¾@.02
Paris green, pure, bulk	"	.17¾@.20½
Red lead, American	"	.06¾@.07
Foreign	"	.08¼@.09½
Turpentine, spirits bbl., per gal.		.62@.63½
White lead, Am., dry	lb.	.05¾@.06
American, in oil	"	.07@.07½
Foreign, in oil	"	.09@.09¾
Zinc white, Am. extra dry	"	.05½@.05⅝
French, proc's, red seal, dry	"	.06¾@.07½
French, process, green seal, dry	"	.07¼@.07½
PHOSPHATES—Acid		.55@60c. per unit
*Fla., hard rock 77%		7.00@7.50
land pebble 68%		3.75@4.00
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock 60%		3.50@4.00

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—		
Bicarbonate crystal	lb.	$.07½
Powdered or granulated	"	.08
Bichromate, Am.	"	.07⅞@.08
Scotch	"	.10¾
Bromide	"	.20
Carbonate (80@85%)	"	.03⅝@.03¾
Caustic, ordinary	"	.05¼
Elect. (90% KOH)	"	.06@.06¼
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.09@.09¾
Crystals	"	.08¾@.09⅛
Cyanide (98@99%) Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons		.19
Kainite, long ton, bulk, 8.50; bags,		8.50
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13¾
Red	"	.29@.32
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. R. R.	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported, non-arsenical, furnace size, ex-ship, per unit		.12½
Imported, arsenical, furnace size, ex-ship, per unit		.11½@.12
Imported fines, arsenical, ex-ship, per unit		.09
Imported fines, non-arsenical, ex-ship, per unit		10½@11c.

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

SALT—N. Y. com. fine 280 lb.	bbl.	.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals	"	5.25@5.87½
SILICA—		
Ground quartz, ord'ry.	lg. ton.	7.00@15.00
Silex, ground	"	7.00@15.00
Silex, floated	"	35.00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—Acetate	lb	.04½@.05
"Alkali," per 100 lb., 58/48		.90@.95
Bicarb. soda, per 100 lb		1.00@1.30
Soda, caustic, per 100 lb., 78/60		1.72½@1.85
Soda, caustic, powdered		.02½@.03
Salt cake, per 100 lb., bulk		.40@.42
Salt cake, bbl		.75@.85
Soda, monohydrate, per lb.		1.30@1.75
Bichromate	lb.	.05¾@.06½
Bromide	"	.20
Chlorate, com'l	"	.08½@.09½
Cyanide, 120-130% KCN, per 100% Carloads (30,000 lb.)	lb.	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	.20
Hyposulphite, Am.	"	1.30@1.50
Phosphate	100 lb.	2.10@2.40
Prussiate		.08½@.09
Sal soda, f.o.b. N. Y.	"	.60@.75
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.65@1.00
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.80
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07½@.08
SULPHUR—Louisiana (prime) to New York	lg. ton.	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1.85@2.15
Flour	"	2.00@2.40
Flowers, sublimed	"	2.20@2.60
Powdered commercial, bags		1.55
Sicilian, extra qual., unmixed seconds, crude brimstone to New York	lg. ton.	$22.00
TERRA ALBA—Fr.&Eng.	100 lb.	.70@1.00
TALC—Domestic	sh. ton.	12.00@20.00
French	"	15.00@25.00
Italian, best	"	30.00@40.00
TIN—Bi-chloride, 50°	lb.	.10
Crystals	"	.22½@.24
Oxide, lb	"	.37@.40
URANIUM—Oxide	"	2.20@4.25
ZINC—Chloride sol., com. 20°	"	.02½
Chloride, granular	"	.04½
Dust	"	.06½
Sulphate	"	.02@.02½

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